

Estimating tax gap is everything to an informed response to the digital era

Neil Warren*

Abstract

Measuring tax gap highlights ‘everything’ an expanding digital era might mean for tax – and not just tax non-compliance. Since tax gap measures the difference between the theoretical tax liability and actual revenue collected, its measurement transparently links tax policy design, revenue administration performance and taxpayer behaviour to the broader questions of economic growth, fiscal sustainability and fiscal effort and capacity. It also asks fundamental questions about data and its integrity as reported by the revenue administration, the official statistician and business and individual taxpayers. What tax gap estimates can therefore do is bring transparency and understanding to otherwise complex issues arising from the digital era and therein facilitate an informed evidence-based response to its impact through changes to tax policy design, legislation and administration.

Key words: tax gap, digital era, revenue administration, tax policy

* School of Taxation and Business Law, UNSW Business School, UNSW Sydney 2052 Australia;
email: n.warren@unsw.edu.au.

1. TAX GAP IS EVERYTHING

Tax gap is the difference between the tax theoretically due from taxpayers and that actually collected. As the digital era impacts every aspect of the global economy, it is inevitable that it will impact the tax gap. Not surprisingly, an increasing number of revenue administrations are now undertaking tax gap estimates.¹ However, it is the contention of this article that tax gap has many more interested stakeholders than just revenue administrations, particularly since the digital era has an impact well beyond just the tax system. While the digital era is challenging tax system administration, it is increasingly raising questions about the sustainability of the current design and related regulatory frameworks and whether the digital era is precipitating a broad paradigm shift which cannot and should not be constrained as it has economic and social benefits outweighing any concerns about their impact on tax systems.

This article argues that the traditional focus on a technical approach to measuring tax gap by revenue administrations overlooks the fundamental insight and transparency its estimation can bring to a broad range of stakeholders on the performance of the tax system within the broader economy when subject to change. Too often challenges to tax system integrity are responded to inappropriately because they are framed narrowly and responded to reactively at an individual stakeholder level.² This is a particular vulnerability with tax gap estimates prepared by revenue administrations as part of their compliance program and responded to in isolation of the broader policy and regulatory framework.

Understanding how tax gap can be ‘everything’ to tax in a digital era is best demonstrated through an approach which is framed holistically around a clear understanding of what tax gap analysis is, and is not – which is the focus of section 2. In particular, section 2 will show that tax gap is not an end in itself but a means of transparently providing evidence on stakeholders understanding of otherwise complex issues and interactions arising from tax policy design, revenue administration performance and taxpayer behaviour.

Section 3 outlines that while there is no single approach to measuring tax gap, this is not a limitation as undertaking such studies is about developing the evidence base to inform deliberations on tax integrity and tax design sustainability. It will be clear that,

¹ Amongst the 36 OECD countries, over 20 have publicly indicated they estimate tax gap, including: UK (HM Revenue and Customs); US (Internal Revenue Service); Denmark (Danish Tax and Customs Administration (SKAT)), Finland (Finnish Tax Administration (Vero Skatt)), Australia (Australian Taxation Office), Sweden (National Tax Agency (Skatteverket)); Italy (Italian Revenue Agency); Chile (Chilean Internal Revenue Service (SII)); Mexico (Tax Administration Service (SAT)); Estonia (Estonian Tax and Customs Board), and Canada (Canada Revenue Agency). The European Commission also estimates VAT gap across its member countries, and in Latin America, Argentina, Chile, Colombia, Peru, and Uruguay have all estimated various tax gaps. The International Monetary Fund (IMF) through its RA-GAP program has now undertaken projects to estimate VAT gap in: Columbia, Cote D’Ivoire, Denmark, Estonia, Finland Greece Jordan, Morocco Nepal, Peru, Philippines, Portugal, Slovakia, South Africa, Thailand, and Uganda. The World Bank is also including tax gap projects within its reviews of country tax regimes.

² For example, individual taxpayer over-claiming of deductions may prompt a revenue administration to respond with an improved education program on deduction, but deduction non-compliance may also be related to income under- (or non-) reporting and inadequate education of both taxpayers and tax agents. Similarly, business non-payment of employee superannuation entitlements and wage-related income tax instalments may also be associated with cash income under-reporting and the deduction of private expenses as business deductions. A study of business and personal income tax gap would highlight all these issues and their interlinkages.

through tax gap analysis, questions are raised which cannot be easily answered, especially those which have their resolution through trade-offs between various stakeholder interests. In fact multiple methods for informing on the same issue is a strength of tax gap analysis as different approaches add to the knowledge and insight into complex issues. Section 4 builds on the analysis in sections 2 and 3 to highlight how tax gap analysis can bring transparency and evidence to how a number of digital era ‘what if’ scenarios impact on revenue administration and policy design, and section 5 concludes.

What will be clear is that tax gap, holistically and comprehensively framed, can do much to bring transparency through providing an evidence base on the issues arising from the tax impact of the digital era and the source of any tensions involved in any response.

2. TAX GAP FRAMED

2.1 Why tax gap is important

Tax gap is the difference between potential tax collections and actual tax collected. This is important not just because it highlights potential revenue lost through administration issues, but because it can demonstrate how legislated tax design intent can be compromised through its implementation and administration. In addition, tax gap can provide evidence of design inefficiencies arising from unintended tax induced economic distortions to taxpayer behaviour evident in the difference between actual and potential tax revenue. Tax gap also highlights inequities arising from not everyone paying their fair share of the intended tax burden. Issues related to the simplicity objective of good tax design will also be revealed through tax gap estimates demonstrating how complexity might result in reduced compliance because of the high costs in complying with the law. Tax system sustainability will also be revealed through examining trends in revenue risks evident in tax gap trends over time.

Tax gap studies also force consideration of what constitutes ‘potential’ tax collections as they ask the question, ‘in collecting current revenue, is the current system the preferred place to start?’ Invariably the answer will be ‘no’, such that there is not only a tax compliance gap issue raised by such studies but a tax policy gap issue where the former relates to administering the current system and the latter with a system where there is an alternative and preferred policy design. Inevitably different stakeholders will have different interests in tax gap and expectations about estimates and their use.

Tax compliance gap is clearly of direct relevance for a revenue administration as a measure of their performance outcomes and the overall effectiveness of the administration, and time series compliance gap estimates assist it in understanding trends and changes of taxpayer non-compliance and possible response strategies.³ For a treasury or ministry of finance, they need to understand evolving fiscal risk and the need for additional revenue mobilisation. Here tax compliance gap and tax policy gap can inform actions, the former on both integrity in the current systems administration and sustainability of current design, while the latter informs on revenue lost through adopting a system other than some preferred tax policy design. For the official

³ Thackray (2012b; 2012c) notes that for the HMRC, tax gap forms an important part in the development of its vision and strategic objectives, in bringing transparency to performance management and evaluation, strategic resource allocation and business planning, and the publication and dissemination of current and planned research.

statistician, tax gap is of interest as it can provide an insight into non-observed and unregistered economic activity which has the potential to impact the official recording of national accounts statistics. In fact all government administrations that provide input into government policy and its administration have a stake in what tax compliance gap and tax policy gap might reveal, particularly agencies administering social transfer policies.

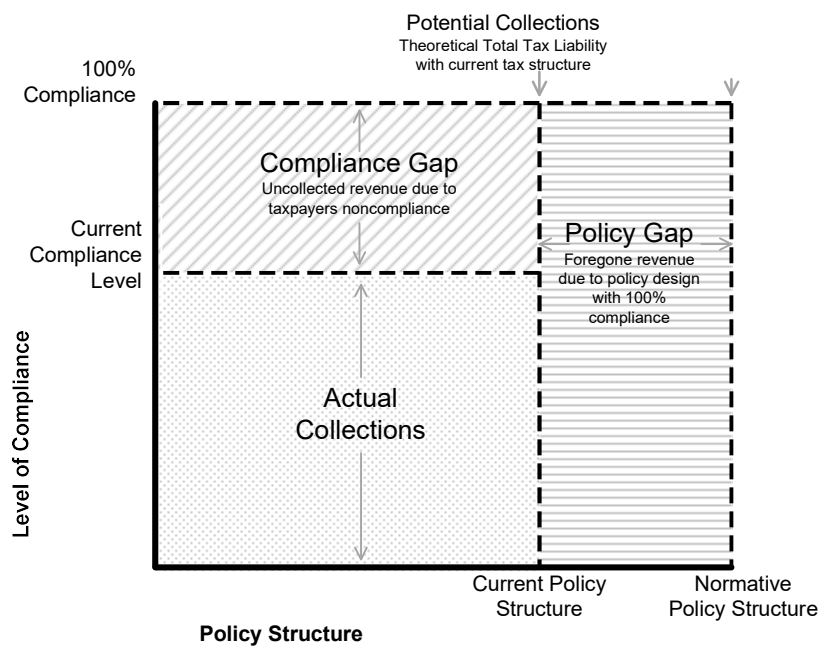
For the community (and their elected representatives), tax gap is important as it provides transparency to any inequities and economic inefficiencies arising from non-compliance or from adopting particular tax policy designs.

While the case for measuring tax gap is clear, less clear is exactly how to go about its measurement in practice. The first and obvious challenge is to define both theoretically and practically what is meant by tax gap.

2.2 Understanding tax gap

Figure 1 details the International Monetary Fund (IMF) proposal for measuring tax gap, with a distinction drawn between tax compliance gap which is the difference between actual collections (T^{AP}) and the potential tax collections given the current policy structure (T^{TL}); and tax policy gap⁴ which is the difference between the potential tax collections given the current policies and the potential collections given some normative or preferred policy (T^*) design.

Fig. 1: IMF Compliance and Policy Gaps



Source: IMF (2015a, p. 64); Toro et al. (2013, p. 50).

⁴ Examples of sources are revenue loss attributable to provisions in tax laws that allow an exemption, a special credit, a preferential rate of tax, or a deferral of tax liability. Policy gap is more than tax expenditures and includes the revenue costs of poor design arising from distortions.

There is no reason why tax gap studies cannot be expanded beyond taxes by a revenue administration if it was also administering negative taxes (such as tax credits and subsidies) or social (income-contingent) transfer programs. Taxes administered could also have linked to them in any gap analysis burdens arising from (in)efficient tax policy (or deadweight losses DWL) and from complex legal design that results in an administrative cost (A) for government and a compliance costs (C) for the taxpayer. In this case the burden of a tax (T^R) when broadly cast can be defined as:

$$T^R = T^{TL} + T^{TE} + T^E + DWL + A + C \quad (1)$$

where:

- T^{TL} theoretical legally liable tax with current policy design, 100% compliance and inclusive of observed and non-observed activity;
- T^{TE} additional tax potential⁵ with standard rates and mandatory (or minimum typical) exemptions compared to current policy exemptions;
- T^E additional tax potential with standard rates and no exemptions compared to mandatory (or minimum typical) exemptions;
- DWL deadweight loss or distortion to resource allocation from the tax rate and base design (excluding A and C)
- A administration cost to the government of collecting revenue
- C compliance cost for taxpayer (monetary and non-monetary) incurred in meeting their tax obligations.

In this case the cost of revenue administration (A) is modelled as detracting from revenue from the tax system. If in practice, there is less than 100% compliance, such that there is a gap between T^{TL} and tax actually liable T^{AL} due to this non-compliance T^{NC} then:

$$T^{TL} = T^{AL} + T^{NC} \quad (2)$$

and since tax actually liable (T^{AL}) includes tax actually paid (T^{AP}) plus tax debt which is liable but unrecoverable (T^D) then:

$$T^{AL} = T^{AP} + T^D \quad (3)$$

Of the tax actually collected, some is paid voluntarily T^V and some is the result of compliance activity by the revenue administration T^C such that:

$$T^{AP} = T^V + T^C \quad (4)$$

Incorporating (3) and (4) into (2), then:

$$T^{TL} = T^{AL} + T^{NC} = T^{AP} + T^D + T^{NC} = T^V + T^C + T^D + T^{NC} \quad (5)$$

The difference between T^{TL} and T^{AP} has been termed the Net Tax Gap G^N :

$$G^N = T^{TL} - T^{AP} = T^{NC} + T^D \quad (6)$$

⁵ Tax expenditures must be measured against some normative structure or what the tax base 'ought' to be. In the case of an income tax, this would be all income regardless of source and with personal consumption, all household final consumption expenditure. See Toro et al. (2013).

This measure is revenue lost despite all revenue administration compliance actions. If interest is in what tax was paid voluntarily and timely then T^V is relevant with the difference between T^{TL} and T^V being termed the Gross Tax Gap (G^G). From (5):

$$G^G = T^{TL} - T^V = T^{NC} + T^D + T^C = G^N + T^C \quad (7)$$

with the difference between gross tax gap (G^G) and net tax gap (G^N) equal to:

$$G^G - G^N = T^C \quad (8)$$

Gross Tax Gap G^G has little meaning other than indicating the timely payment of tax liable and while it might be relevant to the revenue administration who is focused on tax due being paid on time, ultimately it is the proportion of accrued tax liability T^{AL} that is paid T^{AP} rather than paid timely T^V that is the important indicator of the final compliance outcome. Tax collected timely T^V is essentially an artificial construct of limited broad policy use other than as an indicator of taxpayer willingness to comply with the legal submission and is not independent of revenue administration resourcing and capability (A). However, as noted in section 3.4 below, there may be interest in T^V when it is disaggregated into that part which is tax assured and that which is not. However, what is more immediately meaningful for the revenue administration is the Collection Gap (T^D) and Compliance Outcome (T^C), variables of concern also to an audit office or a treasury or ministry of finance when evaluating a revenue administration's performance. For government, Net Tax Gap G^N is particularly relevant as this is what revenue it has potentially available to fund expenditure programs.

Including T^{TL} defined in (5) into (1) yields:

$$T^R = [T^V + T^C + T^D + T^{NC}] + [T^{TE} + T^E + DWL + A + C] \quad (9)$$

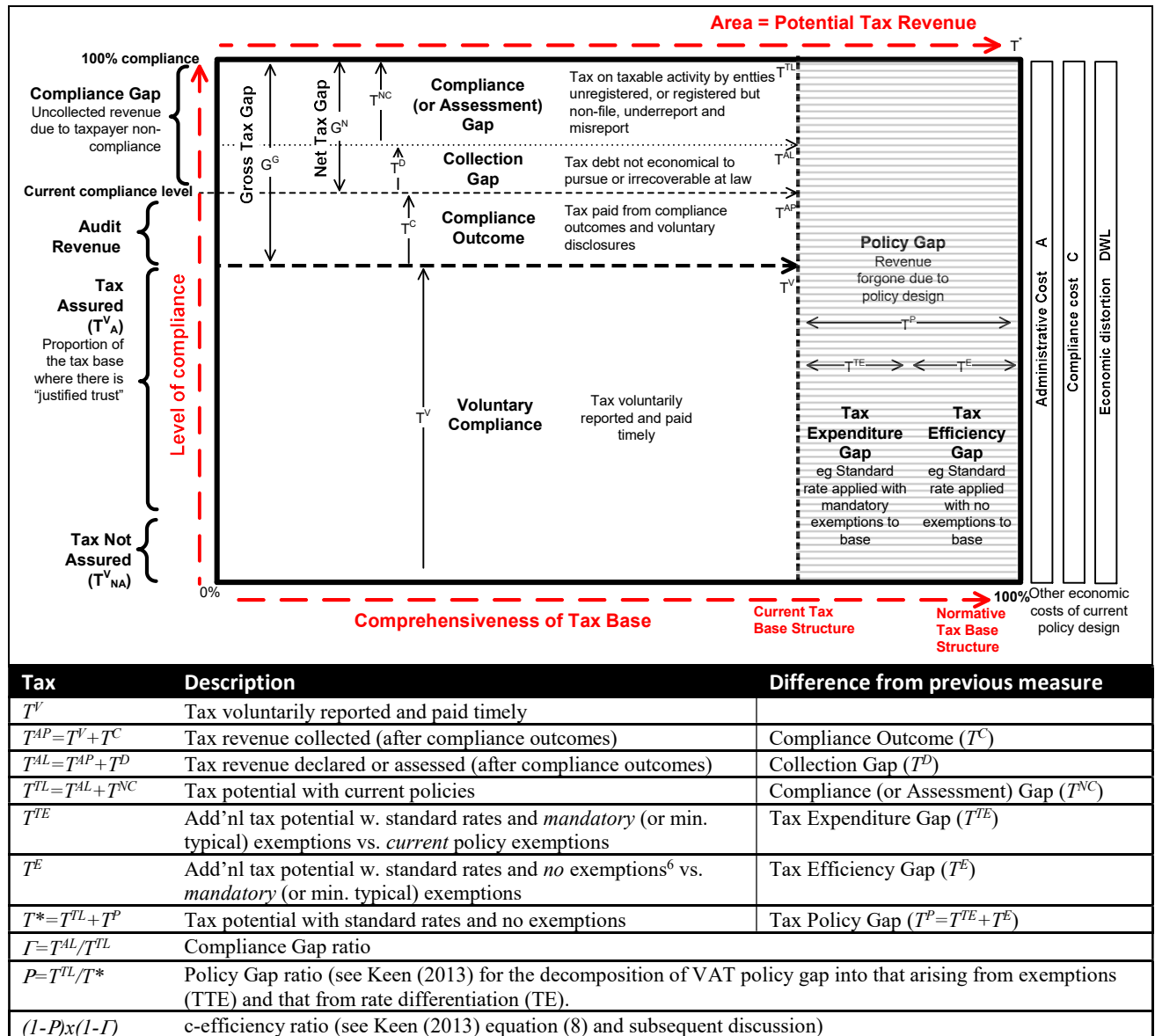
For a treasury or ministry of finance, of particular relevance is why T^{TL} is different from T^{AL} or the Assessment Gap (T^{NC}) and just why T^{TL} differs from T^* or the Policy Gap (T^P). In practice these component parts of T^* cannot be divorced from administrative costs (A) or the tax (rate and base) design, nor can tax expenditures T^{TE} or distortions impacting taxpayer behaviour (DWL), which also impacts taxpayer compliance costs (C). Moreover, non-compliance by taxpayers with the law evident in T^C , T^D and T^{NC} have impacts well beyond just tax to the broader observed economy and onto the non-observed economy of which the black economy is part. Figure 2 brings these elements together and presents a diagrammatic representation of (9). Since many treasuries and ministries of finance already estimate T^{TE} and A is known from the revenue administration budget, these two elements of (9) are often available. If C and DWL estimates are also available, there is little reason not to include T^{TE} , T^E , DWL , A and C in any study estimating G^G and G^N as they indicate the other tax-related costs of current design.

In measuring (9), transparency is also brought to how tax design and the funding of a revenue administration impacts a holistic representation of potential tax revenue. What tax gap estimation does is highlight clearly the inter-related nature of the different measures in (9). The question now is how to move from the theoretical concepts in (9) to practical measures.

In some cases these variables are known such as T^V , T^C , T^D and A but in others they are not such as T^{NC} , T^{TE} , DWL or C . Moreover, the various components of T^R are not independent of A or the tax design (rates schedule and base definition). This endogeneity

must mean that changes in revenue administration and tax design will elicit behavioural responses which revenue administrations (and treasuries and ministries of finance) need to incorporate into their considerations. For example, if A was reduced, T^V would inevitably decline along with T^{AP} and T^D while T^{NC} would increase.

Fig. 2: Tax Gap Framed



Source: author.

⁶ The IMF approach to distinguishing T^E and T^{TE} was to state that: ‘[a]nother way to look at these two measures is that these two components divide the policy gap into the portion where revenue mobilization opportunities exist (the expenditure gap) and the portion where there is little opportunity for revenue mobilization (the efficiency gap)’, and that: ‘[i]n others words the efficiency gap is the portion of the policy gap that results from the typical VAT exemptions necessary due to pragmatic considerations in the design of a VAT’ (Thackray, Hutton & Kapoor, (2015b, p. 7).

Fig. 3: Limits to Scope of Tax Compliance Gap in Practice

Type of economic activity	Explanation	Tax Gap assuming no NOE	Tax Gap assuming some NOE	Tax Gap Components
Non-productive and excluded from economy (and beyond scope of national accounts)	Taxable activities which are neither observed or non-observed eg non-productive activities such as extortion and theft			Tax on non-productive activities
Production of households for own final use	Informal economy involving home production not included in National Accounts			No Tax Revenue Implications
Illegal production	Productive activities that generate goods and services forbidden by law or that are unlawful when carried out by unauthorised producers			T^{NC} from NOE
Underground production (Legal)	Productive activities that are productive and legal but are deliberately concealed from the public authorities to avoid payment of taxes or complying with regulations			
Informal sector production	Productive activities conducted by unincorporated enterprises in the household sector that are unregistered and/or less than a specified size in terms of employment and that have some market production			
OE: Not registered and not reported (ie data deficiencies which could be addressed through random sampling)	Intentional non-compliance	Gross Tax Gap	Net Tax Gap	T^{NC} Tax assessment error from OE (intentional and unintentional)
Observed Production (OE)(Legal): Registered and reported	Unintentional non-compliance: Incorrect reporting for tax due to lack of knowledge (which is done in good faith)			
	Tax Collection Losses (Tax debt)			
	Deterrent Effect (Compliance by risk adverse)			
	Direct monetary effects of tax control			
	Tax paid Voluntarily (Voluntary compliance)			T^V

Definitions

Underground production, defined as those activities that are productive and legal but are deliberately concealed from the public authorities to avoid payment of taxes or complying with regulations

Illegal production, defined as those productive activities that generate goods and services forbidden by law or that are unlawful when carried out by unauthorised producers

Informal sector production, defined as those productive activities conducted by unincorporated enterprises in the household sector that are unregistered and/or less than a specified size in terms of employment and that have some market the and production

Production of households for own final use, defined as those productive activities that result in goods or services consumed or capitalised by the households that produced them.

Source: author.

Equally, changes in economic activity such as that brought about by the digital era will inevitably impact tax gap if it facilitates non-compliance (demonstrated by an increase in T^{NC}). However, this could be counteracted through the technology accompanying the digital era facilitating more effective use of third party data on non-compliant taxpayers and the better utilisation of A , to increase T^C and decrease T^{NC} and T^D .

Crucially, examining tax gap can potentially bring greater transparency to the intended impact (spirit of the law) as against the actual (letter of the law) impact of the tax, along with any impact that was intended but not achieved (G^N). This is particularly important for Treasury or the Ministry of Finance as (9) highlights the important potential revenue from that which is not known, understood or appreciated such as the revenue impact of

taxpayer's behaviour and from failures of policy design. For revenue administrations, (9) highlights how qualitative changes to the revenue administration can impact the effectiveness of expenditure (A) can therefore impact gap estimates G^G and G^N .

The challenge for comprehensive tax gap analysis is therefore to estimate in practice the unknown components of T^* at a point in time including T^{NC} , T^{TE} , T^E , DWL , A or C , and understanding how the known and unknown components of T^* change with context and time. Here context can be framed by changes in the economic environment (as with change arising from the digital era); quantitatively and qualitatively from tax design changes; by time in both a stable economic environment or across the economic cycle; and by demographic social economic and geographic attributes.

In framing T^* in a way that captures the implications of the ascendancy of the digital era, what is important is drawing a link between tax gap and economic activity. Figure 3 highlights how tax is a direct outcome of economic activity. However not all activity theoretically liable for tax will incur tax. Equally economic statistics may not always observe all economic activity – some can be non-observed – as with the black economy. If the digital era allows previously observed activity to become non-observed, then the tax gap will be impacted as will the integrity of the national accounts data if this activity remains unknown and unacknowledged. Ideally, a comprehensively framed tax gap study will capture any change in the mix of observed and non-observed economy and act to inform not only tax gap but also national statistics.

2.3 What tax gap is not

However, it is crucial that the limitations associated with undertaking tax gap estimates are well understood. This will ensure that any findings are applied in a way which is informed and brings transparency to not only what *is* tax gap but what tax gap *is not*.

Principally, tax gap:

- *is not an end in itself*
 - it is a 'means to the end' of improved revenue administration and better tax policy, tax law, tax politics, and national accounts statistics;
 - reducing tax gap and raising revenue are different although related issues;
- *is not just about the 'knowns'*
 - tax gap studies must be complemented with information on the 'unknowns';
 - tax gap involving consideration of issues raised by operational data is not enough. Ultimately random sampling of the whole population is required and the collection of data from many sources;
 - tax gap is not a revenue administration operational performance evaluation measure
- *is not an indicator of taxpayer compliance in the short run*
- *is not just about establishing a single number or range of estimates of tax gap*
 - it is about understanding the nature, drivers and incidence of non-compliance behaviour as reflected in tax gap estimates, which can help guide the best responses to improve compliance;
- *is not independent of increased compliance action*
 - there is a behavioural tax base response to level and quality of compliance activity;
- *is not independent of tax rate (or base)*

- *is not fully collectible*
 - elimination of tax gaps would require universal audits, severe penalties, high burden on the compliant, reduced economic activity and political dissent;
 - it is essential to communicate that a tax gap will always persist and has many complicated aspects;
- *has no 'first best' methodological approach*
 - tax gap research is evolving and highly data dependent so as data access improves, so too will the methodology;
 - a revenue administration can learn from the tax gap research practices of others and devise approaches which best suit their taxes and the resources available.

2.4 Who should measure tax gap?

If tax gap has relevance to everything and everyone, this raises the question of who should take responsibility for its measurement. The answer here is not simple but, given tax gap is important to multiple stakeholders, it must be an open, transparent, cooperative and collaborative undertaking (an issue discussed further in sections 3 and 4).

Since the reasons why tax gap is important for different stakeholders vary widely, the 'what ought to be' tax gap varies for each tax to reflect the complex and dynamic environment in which that tax is imposed on stakeholders and how their interests are expressed. A direct result is that the meaning of the 'what is' tax gap cannot be separated from 'what ought to be' from a stakeholder perspective.

This article will argue that any tax gap study must contextualise its estimates for them to be meaningful and relevant. To this end it will be argued that what is required is a:

1. clear identification of the stakeholders (why the interest in it; and what is it to them);
2. micro-contextualisation of tax gap estimates where the disaggregation of each measure is focused on its contribution to the total, and on the identification of *interactions* between components which are common for different taxes when measuring their respective tax gaps; and
3. macro-contextualisation of tax gap estimates by giving consideration as to how the non-observed and the observed-but-unregistered participants impact it; and how it changes with changes to tax design or revenue administration.

Since it is typically revenue administrations who estimate tax gap, almost all studies focus only on tax compliance gap as their primary responsibility when administering the current tax system, not with the tax policy gap arising from having adopted current policies rather than some more preferred tax design⁷ (which is the ambit of treasuries and ministries of finance). What the analysis in this article will highlight is that, while tax compliance gap is important and will be impacted by the economic transformation accompanying the digital era, so too will the appropriateness of current tax policies and therefore tax policy gap takes on an important role as a complement to any estimates and response to tax compliance gap.

⁷ Denmark has for example had some success in changing the laws to address tax gap. See Pedersen (2017, pp. 14-15).

3. MEASURING TAX COMPLIANCE GAP

Tax compliance gap has many causes and can be linked to both known and unknown sources as shown in Figures 2 and 3. It can arise from *known* information asymmetries which are too costly and difficult to address by the revenue administration or from capacity and capability constraints arising from budget-imposed constraints. As shown in Figure 4, these can be grouped according to whether the *knowns* and *unknowns* to taxpayers themselves are *known* and *unknown* to the revenue administration when undertaking tax gap estimates. What Figure 4 highlights is that most challenging are the *unknowns* which are beyond the revenue administration for legitimate or illegitimate reasons. The challenge for tax gap studies is how to comprehensively measure the various components contributing to the gap and, in the process, to highlight in any approach what goes still unmeasured (or unacknowledged) as with problematic *unknown-unknowns* arising from the non-observed economy (NOE) in Figure 3.

Fig. 4: Tax Compliance Gap and the Unknowns

Donald Rumsfeld, US Secretary for Defense, February 2002:		
‘There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns — the ones we don’t know we don’t know.’		
Tax Gap and the Unknowns		
	Known to taxpayer	Unknown to taxpayer
Known to revenue administration	What revenue administration knows: <i>Non-lodgement/non-filing:</i> Registered for tax purposes but not filing tax returns as required. <i>Underpayment:</i> Reported tax liability not paid on a timely basis, or at all.	What revenue administration does not know: <i>Under-reporting:</i> Filing returns but not declaring all taxable amounts/ events (e.g. wages/ fringe benefits for payroll tax, rental of private residence for land tax)
Unknown to revenue administration	What revenue administration cannot know: <i>Non-registration</i> <i>Non-observed</i> economic activity: Taxable amounts and events that go unrecorded in official data.	What revenue administration do not like to know: <i>Known but ignore</i> (fund low benefit enforcement); <i>Known but not realized as a known</i> (overlooked)

Source: author.

Identifying the *unknowns* therefore requires an understanding of the makeup and operation of the broader economy, whether observed or not by the official statistician. Moreover, while knowing aggregate tax gap is interesting, what are ultimately of most interest are the individual (not collective) factors contributing to it. After all, only with knowledge of these individual sources can a strategy be mapped in response by the revenue administration. As a result, a disaggregated methodological approach which is capable of illuminating the contributing factors to tax gap is essential. However since the source of these factors is often *unknown*, measurement inevitably becomes a process where no single approach provides enough light to illuminate the full subject. As a consequence, this might require a focus on the broader economic aggregates to understand more about NOE, on taxpayer behaviour (individuals or businesses) as they avoid registering for tax, or on revenue administration operational data to measure the impact of actions and decisions on T^{AP} and T^{AL} and how they relate to T^{TL} . While the importance of tax gap and of adopting a disaggregated methodological approach is clear, what is not is how best to measure it in practice, and here data is everything.

3.1 Methodological issues in measuring tax compliance gap

Tax gap has many sources and can be linked to many *unknowns* as noted in Figure 4. However, there are two basic methodologies that have been applied to measuring tax gap in empirical studies. With most studies initiated by revenue administrations, we can group these methodologies in terms of how they relate to the activities of the revenue administration.

The first method is the top-down approach based on data collected from sources *external* to the revenue administration to estimate the theoretical liability for a particular tax based on the application of current tax policy rules. The data is usually high level and identified as capable of providing an independent verification of collection outcomes by the revenue administration through estimating T^{TL} and contrasting it to T^{AP} . Figure 5 outlines how top-down tax gap estimates are made and Figure 6 some examples of data sources used.

The corollary of the top-down approach is the bottom-up approach which uses information available to the revenue administration from *internal* sources accompanied where possible by external sources, to estimate the potential revenue from the tax being administered. Figure 5 outlines the steps in undertaking bottom-up tax gap estimates and Figure 6, the data sources used.

In theory, both top-down and bottom-up approaches should be able to be reconciled as shown in Figure 5. Although it is common for these approaches to be seen as alternative methods of measurement, as the IMF has stressed, they should be seen as complementary with the bottom-up approach providing a benchmark against which to assess top-down approaches. At its simplest, bottom-up approaches are measured from revenue administration operational data and available third party data at the taxpayer level which allows summing across the population of taxpayers to obtain national aggregates. What is missing in this approach is insight into *unknowns* as illustrated in Figure 4 relating to income under-reporting, non-lodgement and non-filers (in T^{NC1} and T^{NC2} in Figure 5). It is here that the use of random sampling of the population beyond current lodgers becomes important in the bottom-up approach, while acknowledging that, even then, not all non-compliance might be detected (defined as T^{NC2} in Figure 5).

Evaluation of the different approaches, their associated methodologies and how they are applied in practice is neither easy nor straightforward. The IMF in its 2013 review of the UK tax gap methodology (Toro et al., 2013) made a number of recommendations in terms of appropriate criteria for assessing reliability. The Australian Taxation Office (ATO) in its tax gap estimates has extended and refined these criteria which are outlined in Box 1. Using this approach, it is possible to assess, compare and contrast the different approaches, their findings and associated reliability. The approach by the ATO is internationally an exemplar of its kind.

The ATO currently applies these criteria to compliance gap estimates for the taxes shown in Figure 8⁸ along with the methodology adopted when estimating tax compliance gap. By way of contrast, the most comprehensive study of tax gap available

⁸ See estimates at ATO, 'Australian tax gaps – overview, summary findings', https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/Australian-tax-gaps-overview/?page=2#Summary_findings (accessed 29 January 2019).

publicly is that undertaken in the UK and, as shown in Figure 9, a complex range of alternative methodologies is adopted.

Importantly, no single methodology is ‘best’ as undertaking such studies is an evolving process of constant refinement. A review of past UK tax gap reports highlights how the methodology adopted for different taxes has changed markedly over time,⁹ moving variously between top-down, bottom-up and a mixed methods approach, driven by experience, improved data access and methodological refinements.

Fig. 5: Top-down and Bottom-up Tax Compliance Gap Methodologies¹⁰

Top-down approach	Bottom-up approach	Net Tax Gap (G^N)	Gross Tax Gap (G^G)
<div style="text-align: center;"> </div>	<div style="text-align: center;"> </div>		
<p>Tax Paid (T^{AP})</p> <hr/> <p>Theoretical tax liability (T^{TL}_1)</p> <p>T^{TL}_1 is derived by direct estimation using data sourced external to the revenue administrations operational data and applying to it, current tax rules.</p>	<p>Tax paid voluntarily (T^V)</p> <p>+ Compliance outcomes (T^C)</p> <p>= Tax Paid ($T^{AP} = T^V + T^C$)</p> <p>+ Tax debt irrecoverable at law etc (T^D)</p> <p>= Tax Due ($T^{AL} = T^{AP} + T^D$)</p> <p>+ Unreported tax liability never assessed (T^{NC1})</p> <p>+ Non-detection estimate (T^{NC2})</p> <p>= Theoretical tax liability (T^{TL}_2)</p> <p>T^{TL}_2 is derived by the estimation and addition of its component parts.</p>	<p>T^D</p> <p>T^{NC1}</p> <p>T^{NC2}</p>	<p>T^C</p> <p>T^D</p> <p>T^{NC1}</p> <p>T^{NC2}</p>
<p>Net Tax Gap (G^N_1) = $T^{TL}_1 - T^{AP}$</p> <p>Net Tax Gap % = G^N_1 / T^{TL}_1</p>	<p>Net Tax Gap (G^N_2) = $T^{TL}_2 - T^V - T^C = T^D + T^{NC}$ where $T^{NC} = T^{NC1} + T^{NC2}$</p> <p>Net Tax Gap % = G^N_2 / T^{TL}_2</p> <p>Gross Tax Gap (G^G) = $T^{TL}_2 - T^V = T^C + T^D + T^{NC}$ where $T^{NC} = T^{NC1} + T^{NC2}$</p> <p>Gross Tax Gap % = G^G / T^{TL}_2</p>		
<p>Actual data available: T^{AP}</p> <p>Estimated: T^{TL}_1</p>	<p>Actual Data Available: T^V T^C T^D</p> <p>Estimated: T^{NC1} T^{NC2}</p>		

Note:

- (1) The arrows illustrate the direction of calculation under each gap approach.
- (2) Partial validation of approaches results derived can provided by testing if $T^{TL}_1 = T^{TL}_2$. However, the level under both T^{TL}_1 and T^{TL}_2 could have limitations so comparing T^{TL}_1 to T^{TL}_2 cannot be a definitive test and therefore validation of results from either approach.

Source: author

⁹ Contrast for example the information reported in Figure 8 below derived from HM Revenue and Customs (2018b) with the information in the same figure from previous year editions of this annex.

¹⁰ See HM Revenue and Customs, ‘Official statistics: Measuring tax gaps’, <https://www.gov.uk/government/statistics/measuring-tax-gaps> (accessed 29 January 2019).

Fig. 6: Information Sources for different Tax Compliance Gap Approaches

Top-Down approach	Bottom-Up approach
National accounts data for GST Tax Gap	Operational data for personal and company tax gap
Data collected from other jurisdictions (eg States) for Personal Income Tax PAYG instalments gap	Managerial data on auditor performance and outcomes to uplift collects to reflect non-detection
Data collected by other government administrations (e.g. Customs) for Alcohol and Tobacco excise gap	Professional judgement to reflect what might be non-observed by auditors in case reviews
Data collected by other statistical administrations on non-observed economy	Random Audit to gain insight into known-unknowns

Source: author.

Fig. 7: Tax Compliance Gap Approaches: Advantages and Disadvantages

Rank	Approach	Description	Advantages	Disadvantages
3	Top-down	Use aggregate (external) data that is compiled externally and independently of the revenue administration, that can be applied directly or indirectly to estimate the taxable base for a tax. Statistical calculations based on broad observations e.g. Australian Bureau of Statistics (ABS) data.	Simple Independent Macro approach (from the general to the specific)	Data weaknesses aggregate approach circularity
2	Bottom-up	Management Information from normal operational programs: Data warehouse and risk engine Data matching (internal and external sources) Random audit enquiries to complement management information Illustrative data from operational experts	Disaggregation to the taxpayer level Micro approach (from the specific to the general)	Endogeneity- Data does not look beyond knowns uplift factors for unknowns
1	Combination (Ideal)	Utilising a combination of top-down and bottom-up approaches	Enables verification	May not be able to match approaches

Source: author.

Box 1: ATO Tax Gap Estimates Reliability Assessment Criteria

The ATO assesses its tax gap estimates for reliability against ten criteria designed to provide transparency and consistency to its assessment of each gap estimate. The ratings developed by the ATO are then provided to an external expert panel along with ATO initial views and supporting material. The expert panel then assesses each submission and provides feedback for improvements. Once all feedback is addressed, the panel endorses a final score.

The ten reliability criteria are considered of equal importance and address three areas: the estimation framework, the methodology and finally, the internal ATO processes and delivery. The criteria used are as follows:

Estimation framework: To what extent does the estimate:¹¹

- capture the appropriate tax base
- cover all potential taxpayers
- account for all potential forms of non-compliance
- avoid overlap between any two components of the framework.

Methodology: To what extent does the estimate:

- meet IMF methodology criteria for alternative methodologies¹²
- use multiple approaches that are validated internally and against accepted international standards
- sensitivity test for underlying changes in the model, structure and assumptions
- evaluate and assess assumptions, judgment or expertise used.

Internal processes and delivery: To what degree is the estimate evaluated for:

- reliability and repeatability of data and documentation
- testing, evaluation and measurement against other sources, both internal and external.

Source: ATO, 'Principles and approaches to measuring gaps, reliability assessment', <https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/Principles-and-approaches-to-measuring-gaps/?anchor=Reliabilityassessment#Reliabilityassessment> (accessed 30 January 2019).

Fig. 8: ATO Tax gap Approach by Tax

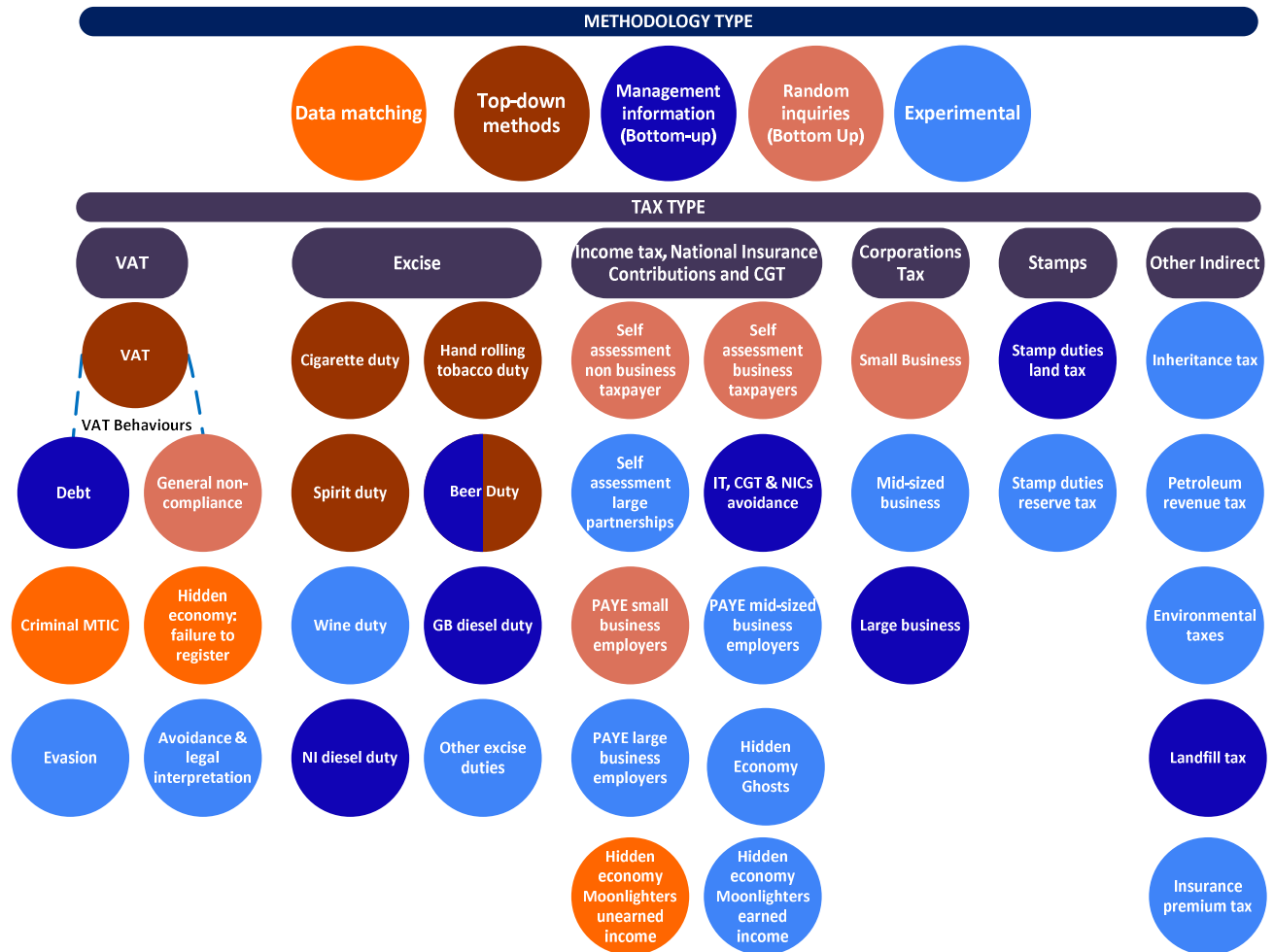
Tax	Methodology
Fuel excise	Top-down
Fuel excise credits	Bottom-up
Tobacco excise	Bottom-up
Goods and Services Tax	Top-down
Large corporate groups income tax	Bottom-up
Individuals not-in-business	Bottom-up
Large Superannuation Funds	Bottom-up
Small Superannuation Funds	Bottom-up
Wine equalisation tax	Top-down
PAYG withholding	Bottom-up
Superannuation guarantee	Bottom-up

Source: ATO, 'Tax gap', <https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/>.

¹¹ This is based around criteria outlined in Box 2 of Toro et al. (2013).

¹² This is based around criteria outlined in Boxes 3, 4 and 5 in Toro et al. (2013).

Fig. 9: UK Tax Gap Methodology¹³



Source: HMRC (2018b, p. 4).

3.2 Tax assurance and tax gap

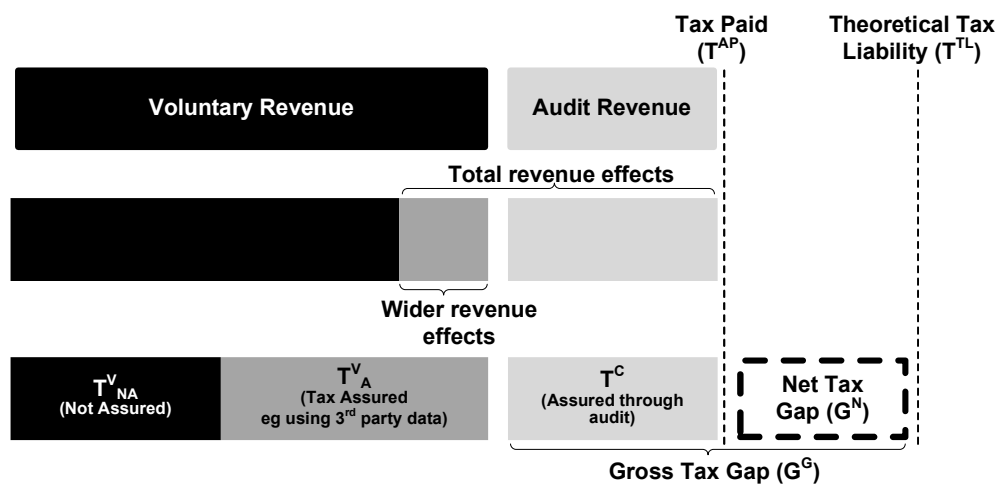
The focus in the above discussion has been on tax gap measurement and its decomposition. However, a critical question not addressed in this discussion is about the reliability and meaningfulness of tax voluntarily paid (T^V). After all, tax voluntarily paid does not necessarily mean the tax paid can be ‘trusted’. A useful complement to tax gap analysis must therefore be an estimate of what part of T^V a revenue administration can have ‘justified trust’ in that the tax paid can be assured. The Organisation for Economic Co-operation and Development (OECD) noted this and how ‘[t]ax assured is conceptually a very strong measure because it summarises information on core compliance outcomes’ with tax assured measuring ‘the proportion of the tax base where the revenue body has “justified trust” through its activities or others’

¹³ See HM Revenue and Customs, ‘Official statistics: Measuring tax gaps’, above n 13.

activities that tax is “under control” and so assured as accurate and paid’ (OECD, 2014, p. 51).

While the OECD (2014) provides no specific practical guidance on how to measure tax assured, Figure 10 contrasts this measure with other administration performance measures such as audit yield, total revenue effects and wider revenue effects. In a practical sense, tax assured (T^V_A) arises when the revenue administration can be assured it has ‘justified trust’ in T^V such as when it is pre-filing personal income tax returns using third party information. Where there is a reliance on the taxpayer to volunteer information without third party corroboration (as with income deductions claimed without verification), the tax related to it (T^V_{NA}) is not tax assured as there is no ‘justified trust’ in the information submitted.

Fig. 10: Measures of Revenue Outcomes



Source: Author’s adaptations to OECD (2014, Figure 3.2).

The concept of tax assured is gaining some acceptance with the ATO adopting it as a performance measure related to its four pillars of compliance¹⁴ and the Canada Revenue Agency (CRA)¹⁵ estimating it for the Canadian Personal Income Tax.

Building on Figures 2 and 5, it is possible to disaggregate T^V in (4) into that part which is tax assured and that which is not, and relate them to tax gap. If:

$$T^{AP} = T^V_A + T^V_{NA} + T^C \text{ then} \tag{10}$$

$$T^V = T^V_A + T^V_{NA} = T^{AP} - T^C \tag{11}$$

and as Gross Tax Gap (G^G) is the difference between T^{TL} and T^V (7), tax not assured

¹⁴ Tax assured is a performance measure, is outlined in ATO (2017) and noted on the ATO website as one of the OECD four pillars of taxpayer compliance it adopted in 2014: ATO, ‘The OECD four pillars of compliance’, <https://www.ato.gov.au/General/Tax-and-Corporate-Australia/In-detail/The-OECD-four-pillars-of-compliance/> (accessed 30 January 2019).

¹⁵ The approach in the Canadian study was to focus on assurances about the base and not related tax revenue. As a result they estimated ‘assured income’, ‘assured deductions’ and ‘assured credits’ - but neither aggregate ‘net income’ assured nor net tax assured. See Canada Revenue Agency (2017).

T_{NA}^V can be added to G^G to estimate the proportion of T^{TL} in which the revenue administration *cannot* have ‘justified trust’.

From (6), (7) and (11), by definition:

$$T^{TL} = T^V + G^G = T^{AP} + G^N = T^V + T^C + G^N = T_{NA}^V + T_{NA}^V + T^C + G^N = T_{NA}^V + T_{NA}^V + G^G \quad (12)$$

where theoretical tax liability assured T_{NA}^{TL} is equal to T_{NA}^V and theoretical tax liability not assured T_{NA}^{TL} is $(T_{NA}^V + G^G)$.

The proportion of T^{TL} assured (T_{NA}^{TL}) and not assured (T_{NA}^{TL}) therefore becomes:

$$\%T_{NA}^{TL} = T_{NA}^V / T^{TL} \quad (13)$$

$$\%T_{NA}^{TL} = (T_{NA}^V + G^G) / T^{TL} = 1 - \%T_{NA}^{TL} \quad (14)$$

The approach above assumes T^C is not tax assured on the basis that, without the compliance activity by the revenue administration, this revenue would not have been assured. What is then of particular interest to the revenue administration is the proportion of tax actually collected (T^{AP}) that can be assured (T_{NA}^V) or not assured (T_{NA}^V), defined as:

$$\%T_{NA} = T_{NA}^V / T^{AP} \quad (15)$$

$$\%T_{NA} = (T_{NA}^V + T^C) / T^{AP} = 1 - \%T_{NA} \quad (16)$$

Few official estimates are publicly available for tax assured defined in (13) and (15). Canada has published estimates of tax assured for the personal income tax; however the approach taken focused on the ‘assured tax base’ rather than ‘assured tax’. The Canadian approach is relatively simple to demonstrate along with its limitations. Defining the tax base (B^{AP}) related to the tax paid (T^{AP}) for the personal income tax as:

$$B^{AP} = (Y_A + Y_{NA} - D_A - D_{NA}) \quad (17)$$

then what the Canada Revenue Agency (CRA, 2017, section 3) has estimated is:

$$\text{Assured Income} = Y_A / Y \text{ where } Y = (Y_A + Y_{NA}) \quad (18)$$

$$\text{Assured Deductions} = D_A / D \text{ where } D = (D_A + D_{NA}) \quad (19)$$

$$\text{Assured Credits} = R_A / R \text{ where } R = (R_A + R_{NA}) \quad (20)$$

where Y is all income sources; D deductions; R tax reliefs and the subscripts A and NA relate to assured and not-assured values respectively.

There are five limitations of this CRA (2017) approach to personal income tax:

- (i) There is no net income measure: $(Y_A - D_A)$ or $(Y - D)$;
- (ii) There is no acknowledgement that exempt income¹⁶ should also be subject to the tax assurance process;
- (iii) There is no net tax measure: (T_{NA}^V) or T^{AP} ;

¹⁶ Exempt income misclassification can result in tax gap and requires assessment in any estimates of tax assured. This is introduced as exempt income E in Figure 12 and should be included in both tax assured and tax gap estimates.

- (iv) Components related to T^C are interpreted as tax assured but should be defined as not tax assured if they were identified as relevant only as a result of compliance activity; and
- (v) There is no consideration of tax compliance gap.

With both taxable income and tax being a net calculation (involving both additions and subtractions), what is important and difficult to ascertain from the Canadian tax assurance estimates is both the nominal and proportional measures of either the net tax assured or that part of net taxable income which can be assured.

One possible solution to issues (i) and (iii) above is to sum the absolute value of all net income component parts. Since Y_{NA} is typically substantially less than Y_A , we can reasonably assume that t_{av} is the average tax rate on assured income (Y_A) in which there is 'justified trust'; and t_m is the marginal tax rate to apply to income (Y_{NA}) in which there is no 'justified trust' as this is the rate most relevant when calculating revenue risk at the margin for an individual taxpayer. On this basis:

$$\text{Absolute measure of Assured Net Income: } Y_A + D_A + R_A / t_{av} \quad (21)$$

$$\text{Absolute measure of Income: } Y + D + R_{NA} / t_m + R_A / t_{av} \quad (22)$$

$$\% \text{Tax Base Assured: } (Y_A + D_A + R_A / t_{av}) / (Y + D + R_{NA} / t_m + R_A / t_{av}) \quad (23)$$

The measure based on the summation of absolute values involved in the tax computation of net income serves to effectively highlight the revenue risk associated with the different components of the base and therefore the individual sources of risk to tax revenue.

Focusing on the components of net income or aggregating their absolute value might be informative, but ultimately revenue administrations are interested in the tax at risk and therefore net tax rather than net taxable income. The question then is how to develop a measure of 'net tax' assured which is both meaningful and able to be easily explained, when the tax base is a 'net calculation' as is the case with any personal income tax.

If risk to tax revenue arises individually from its component parts then risk is best reflected in the absolute value of all the elements contributing to tax. This overcomes the issue that tax paid is a net tax measure and that risk comes from the component parts of taxable income which a net tax measure might not fully reveal because of their offsetting effect.

A possible approach to measuring net tax assured is to answer the following question: 'Of the absolute value of tax related to all those net taxable income components which go into estimating net tax, what proportion can be assured?'

Building on (21), (22) and (23), we could express tax assured in terms of that absolute value of tax which can be assured (T^A) relative to an *absolute* value of tax derived from its component parts (T^d) where:

$$\text{Absolute measure of Net Tax: } T^d = Y_A \cdot t_{av} + Y_{NA} \cdot t_m + D_A \cdot t_{av} + D_{NA} \cdot t_m + R_A + R_{NA} + T^C \quad (24)$$

$$\text{Absolute measure of Net Tax Assured: } T^A = Y_A \cdot t_{av} + D_A \cdot t_{av} + R_A \quad (25)$$

The proportion of *absolute* tax revenue that can be assured is therefore:

$$\begin{aligned} \% \text{Net Tax Assured} = \\ \% T^A = T^A / T^d = (Y_A \cdot t_{av} + D_A \cdot t_{av} + R_A) / (Y_A \cdot t_{av} + Y_{NA} \cdot t_m + D_A \cdot t_{av} + D_{NA} \cdot t_m + R_A + R_{NA} + T^C) \end{aligned} \quad (26)$$

Tax gap can be readily incorporated into this approach. For a tax with no deductions or reliefs the tax assured proportion of T^{TL} is:

$$\%T_A^G = (T_A + G^G)/(T^{AP} + G^G) \quad (27)$$

The proportion of tax revenue that can be assured using the absolute approach in the presence of deductions and reliefs is:

$$\%T_A^G = (Y_A.t_m + D_A.t_m + R_A + G^G)/(Y_A.t_{av} + Y_{NA}.t_m + D_{NA}.t_{av} + D_{NA}.t_m + R_A + R_{NA} + G^G) \quad (28)$$

In both cases, incorporating tax gap into the tax assured calculations significantly impacts the ratio compared to a case focused only on T^{AP} rather than T^{TL} .

3.3 Tax gap, audit yield and defining success

The analysis above has assumed a one period focus (as evident in Figure 2). However, in practice, revenue administrations are concerned with progressively improving tax compliance and therefore reducing Compliance Gap T^{NC} and Net Tax Gap (G^N). What is therefore important to them is their performance over time in pursuit of this objective. Typically, a series of measures are developed focused on highlighting how their action such as increased audits or changed systems and processes improved revenue yield. However, revenue administrations can never audit their way to full compliance nor should they as it is neither cost effective nor in the interest of the broader economy. The challenge therefore for any administration is to ‘define what is meant by success’ with tax compliance because it cannot be answered solely from their perspective. This is not just because of the public cost of the actual resources used in audits and systems but because it necessarily engages issues beyond the primary focus of the administration. Here issues such as economic growth and employment can be important as is the administration’s impact on other government policies such as transfer payments to the less well-off. Also, the question should be considered of ‘what if the policy being enforced is poorly designed?’, and since increased audit cannot make bad policy good, attention should probably be on policy design as well as audit actions and outcomes.

Too often, the audit function and processes are considered in isolation from the broader context in which this action should be framed.¹⁷ After all, T^{TL} is not independent of tax audits and therefore not independent of tax gap. If it happened that increased tax audits led individuals to withdraw from their non-taxed activities and become dependent on government transfers, increased audits which initially appeared to increase revenue could in fact worsen the government’s overall budgetary position and the level of economic welfare more generally in the economy.

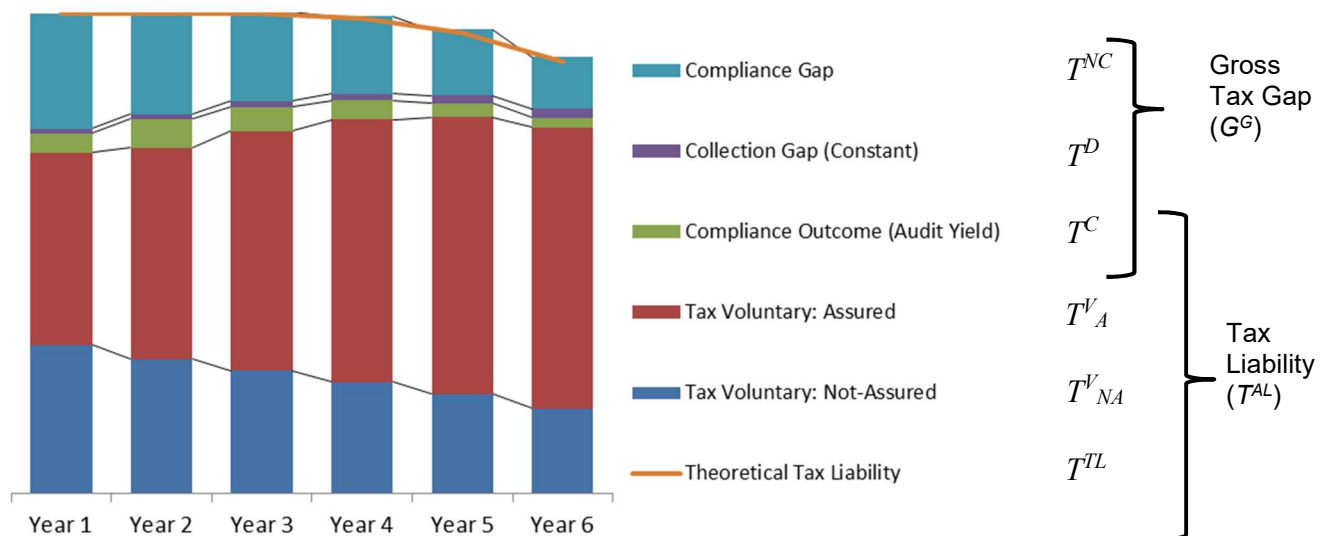
Figure 11 illustrates a hypothetical case where it is assumed that audit costs are constant and audit effectiveness first increases and then decreases, that any audit (compliance) outcomes are maintained (locked in) over time (and added to T_A^V) and that this audit activity initially has no impact on the tax base, but from Year 4 on creates a taxpayer behavioural response which reduces the tax base implicit in T_A^V , T_{NA}^V and T^C . Not taking into consideration any taxpayer behavioural response could risk the revenue

¹⁷ See discussion in OECD (2014) around Figures 3.2 and 3.3 on the total revenue effects of increased audit activity which does not give adequate consideration to the behavioural response to increased audit or to the source of increased revenue from those audits. It is here that the approach outlined in Figure 10 has an important role in complementing Figure 11.

administration claiming success in increasing compliance while ignoring the fiscal and economic cost of its overall impact on other sectors of both the economy and government.

Undertaking tax gap studies over time can clearly highlight the counterpoint to increased compliance being decreased economic activity and the imposition of non-tax-related costs on other government sources such as increased transfer payments to those opting not to engage in taxable activity. Tax agencies must therefore be wary of those effects beyond their own immediate responsibility – which is another reason why a multiple-stakeholder approach to tax gap analysis is critical to the appropriate utilisation of tax gap estimates in practice.

Fig. 11: Tax Gap and Audit Success in Conflict: A Hypothetical Case Study



Source: author.

3.4 Tax gap not independent of tax rate and base

Not only is T^{TL} not independent of compliance (audit) activity, it is also not independent of either the base or tax rate applied. Figure 2 is drawn assuming that tax gap is unchanging regardless of how the tax base is defined. In fact it is reasonable to assume that tax gap declines as the base broadens as the opportunity for a behavioural response designed to minimise tax liabilities centred on the base design (taxed vs non-taxed) is reduced. Figure 2 is also drawn assuming some fixed tax rate schedule is applied. If it was assumed that the higher the tax rate applied the greater is non-compliance then compliance might increase as the rate declines with base coverage, such that at least in part:

1. a decrease in audit activity could be facilitated through reduced tax rates;
2. a decrease in audit activity could be facilitated through base broadening; and
3. compliance issues arising from a rate increase could be offset by base broadening.

However, taxpayer compliance is not just about a rational minimising of their tax liabilities because there is a concern about being detected non-complying (even if that

perception is higher than the reality) and, as Allingham and Sandmo (1972) highlighted, tax morale can explain sustained high levels of tax compliance which are quite independent of tax policy design and how tax revenue is expended by authorities.

Determining the level of audit activity designed to reduce tax gap must ultimately involve issues beyond the revenue administrations such as the appropriateness of the base definition and of the rate structure. Equally, consideration of rate and base design cannot be considered in isolation from tax gap. What should be clear is that estimating tax gap has the potential to provide information for evidence-based responses to compliance actions as well as rate and base design.

3.5 When to measure tax compliance gap and by whom?

As noted in section 2.3, tax gap estimates are not an end in themselves. Rather they are a means of better understanding not just the level but trends in tax non-compliance. This therefore makes it important that tax gap estimation should not be a one-off event but part of an ongoing annually reported systemic issue monitoring program.

Moreover, with the passage of time and as more information is gleaned about non-compliance through tax gap estimation, refinements to methodology are inevitable as are revisions to the findings. In the UK, estimates of tax gap by HM Revenue and Customs (HMRC) now have the status of official statistics and are prepared as a matter of course each year which has the added benefit of requiring them to have a higher level of refinement. However, such status can be counterproductive if it acts against necessary methodological refinements which might result in substantial revisions of previous findings, no matter how justified.

What is clear from international practice is that, while most estimates are undertaken by revenue administrations, there is broad stakeholder interest in these estimates which, as will be noted in section 4, requires tax gap estimates to be undertaken transparently along with the engagement of all stakeholders.

3.6 Contextualising through disaggregation of tax compliance gap

While tax gap aggregate estimates might be interesting, such measures provide little insight into the input causes of such outcomes. Moreover, understanding and operationalising tax gap findings requires consideration of more than just compliance issues. What is needed is a framework capable of factoring in not just policy design limitations; and revenue administration resourcing, capabilities and decisions; but also specific taxpayer behaviour which might be driven by socio-economic, demographic and spatial differences. Through focusing on those groups of taxpayers who are contributing to tax gap along with potential causes and sectoral differences, any policy or administrative response will be more enduring and systematic in approach. This is even more challenging when it is acknowledged that the various factors contributing to tax gap are not independent of, but highly related to, revenue administration compliance activity. This is because its effectiveness is not independent of taxpayer behaviour or tax design. This is why tax policy gap is an important complement to tax compliance gap as some gap can ultimately only be resolved through tax policy reform.

Failure to recognise these linkages is most starkly demonstrated by tax performance outcome measures adopted by revenue administrations that either focus on compliance yield or on measures which do not directly acknowledge their relationship to tax gap. While the OECD (2014) provides a practical guide to a range of performance measures

for a revenue administration, it is disappointing that there is a lack of a formal and direct linking of these measures through to tax gap in its measures. Not doing so brings a lack of transparency as to how tax compliance (and non-compliance) impacts not just liability for the tax or even all taxes, but also the potential design of those policies which they are responsible for administering in practice. It is here that the inclusion of consideration of tax policy gap and how tax impacts the non-observed economy can become important.

For a revenue administration, given its specific responsibilities, it is inevitable that their primary focus will be on the contribution to tax compliance gap from specific taxpayer behaviour and their resourcing, capabilities and approach to administering and enforcing current policy design. Even with this reduced scope, identifying the sources of any tax gap can be complex. For example, in the case of the Personal Income Tax, Box 2 outlines those factors which might be contributing to tax gap and how they might be investigated.

Box 2: Disaggregating Tax Compliance Gap

Understanding those factors contributing to tax compliance gap will require an investigation into:

1. how tax gap for a *given tax* varies:
 - a. with taxpayer behaviour, such as risk aversion evident in their decision to register or not, or to lodge or not, for the tax;
 - b. for different taxpayer socio-economic, demographic and geographic/spatial characteristics;
 - c. with the economic structure (eg observed and non-observed activity mix)
 - d. with the economic cycle (eg behaviour cycles with economic environment)
 - e. with time (eg revealing trends in non-compliance);
 - f. timing of the assignment of the base (or its components) (eg intertemporal issues)
2. how tax gap for *different taxes* varies for the *same taxpayers* (eg common behavioural issues)
3. how components of the base:
 - a. for a *given tax* contribute to tax gap for that tax
 - b. common issues across *different taxes* contributes to overall tax gap;
4. how the compliance actions by the revenue administration on a *given tax* impact the tax gap for:
 - a. the *given tax*
 - b. *different taxes* (with or without common base components)

Source: author.

In the UK Tax Gap estimates, HMRC has sought to estimate what taxpayer behaviour underlies tax gap (Box 2(1a)) including failure through not taking reasonable care, legal interpretation, evasion, criminal attacks, hidden economy, errors, non-payment and avoidance (see HMRC, 2018a, p. 19, Table 1.5). The UK HMRC inclusion of ‘legal interpretation’ does distinguish it from methodologies adopted in other countries by raising the issue of whether taxpayers are complying with the spirit (as adopted by HMRC¹⁸) or the letter (as by the ATO) of the law. The UK approach is, unsurprisingly, controversial as it is possible to argue that any gap arising from differences between the

¹⁸ When using a top-down approach, the HMRC focus on the ‘spirit of the law’ principle is reasonable as it is more readily applied to macro-aggregates such as national accounts data. However, when adopting a bottom-up approach based on more detailed data at the taxpayer level, applying the ‘letter of the law’ principle is possible and likely more appropriate.

letter and spirit of the law should reasonably form part of the gap due to failure to implement preferred policy design which is focused on what ought to be, not part of what is (or current design and legal interpretation). Poor legislative drafting might therefore be more tax policy gap than tax compliance gap.

While some behaviours resulting in tax gap can be identified, some are by definition unknown and others not included or potentially under-represented such as is often the case with illegal activity or alternative assumptions about the size of the non-observed economy in Figure 3. It is here that applying both bottom-up and top-down approaches to verify the findings from either approach can be instructive because the act of reconciliation (G^N_1 and G^N_2 in Figure 5) forces consideration of a range of contributing factors which have different origins as demonstrated from the use of different data sources and applying various assumptions (such as compliance non-detection and NOE uplift factors (Figure 5)).

While common factors contributing to tax gap across different taxes are important (as noted in Box 2), for a particular tax whose base is the sum of various components – as with a personal income tax – what might prove also important is the contribution to the gap for a particular tax from its component parts (as noted in Box 2(3a)). Figure 12 presents the case of a personal income tax, detailing both the policy gap and compliance gap along with how the contribution to compliance gap arising from various component parts Y (income), D (deductions), E (exempt income) and R (tax reliefs) might each (as well as their sub-components) contribute to the aggregate estimate of tax gap. Typically personal income tax gap estimates are made using a bottom-up approach and each component part of the tax base must be subject to gap estimation.

However, what Box 2 has sought to highlight is that tax gap estimation must adopt a holistic approach, recognising that tax gap has many sources and that each tax inevitably is impacted by what occurs with other taxes, all cast in an economy inclusive of both the observed and non-observed sectors and overall to policy design issues.

It is for this reason that estimating tax gap is ‘everything’ to understanding how the digital era might impact on tax integrity and sustainability of the tax system. What undertaking a tax gap estimate requires is an answering of all the tax- and non-tax-related questions which arise from an economic shift such as that accompanying the digital era. Tax gap estimates also serve to highlight how what might be a compliance gap might only be capable of resolution when framed in the context of a tax policy gap. That is, the compliance gap might not be capable of being addressed through audits but only by improved tax policy design.

Fig. 12: Bottom-up Tax Compliance Gap Contextualisation: Case Study of Personal Income Tax

SCENARIOS		
A. Theoretical Tax Liability with no policy exceptions	B. Theoretical Tax Liability with current policy	C. Tax Actually Due and Collected
PARAMETERS		
100% individuals $n = \text{Individuals}$	100% individuals $n = \text{Individuals}$	$n < 100\%$ individuals $n < n$
100% compliance	100% compliance	$< 100\%$ compliance
100% Base	$< 100\%$ Base	$< 100\%$ Base
$B^* = \text{All-inclusive Base}$ (normative policy)	$B = \text{Theoretical (legal) base}$ (current policy)	$B' = \text{Actual (taxed) base}$ (current policy)
$t^* = \text{tax rate}$ (normative policy)	$t = \text{tax rate}$ (current policy)	$t = \text{tax rate}$ (current policy)
BASE (where $Y = \text{All Income}$; $E = \text{Exempt Income}$; $D = \text{Deductions}$; $R = \text{Tax Reliefs}$; $n = \text{Population of individuals}$)		
$B^* = \sum_{i=1}^n Y_i$	$B = \sum_{i=1}^n (Y_i - E_i - D_i)$	$B' = \sum_{i=1}^n (Y'_i - E'_i - D'_i)$
REVENUE (assuming uniform tax rate t with no threshold)		
$T^* = \sum_{i=1}^n t^* \cdot Y_i$	$T^{TL} = \sum_{i=1}^n (t \cdot (Y_i - E_i - D_i) - R_i)$ where T^{TL} is tax legally due with 100% compliance Policy Gap = $T^* - T^{TL}$	$T^{AL} = \sum_{i=1}^n t \cdot (Y'_i - E'_i - D'_i) - R'_i$ where T^{AL} is tax legally due with $< 100\%$ compliance Compliance Gap = $T^{NC} - T^{AL}$ Collection Gap $T^D = T^{AL} - T^{AP}$ where T^{AP} is tax actually collected such that $T^{AP} = T^{AL} - T^D = T^V + T^C$ Net Tax Gap (G^N) = $T^{NC} + T^D$ Gross Tax Gap (G^G) = $T^{NC} + T^D + T^C$
Sources of Tax Gap: Nil as $E=0, D=0, R=0$ and compliance 100%	Sources of Tax Gap: 1. Income exemptions $E > 0$ 2. Deductions $D > 0$ 3. Tax Reliefs $R > 0$	Sources of Tax Gap: 1. Non-filing ($n' < n$) 2. Under-reporting income: $Y' < Y$ 3. Over-claiming: $D' > D, E' > E, R' > R$ 4. Under payment of tax: $T^{AL} > T^{AP}$ ¹⁹
Note: The benchmark Scenario A could be framed more broadly to include not just income sources under current law but all income sources as well as all individuals in the population. Scenario A above should therefore be seen only as comprehensive in terms of the <i>current</i> law, not some alternative more broadly based law.		

Source: author.

While point-in-time tax gap estimates are interesting and open to challenge as accurate absolute measures, time-series gap estimates can in part nullify some methodology criticisms in that they can demonstrate trends and highlight how tax gap estimates are not independent of tax compliance activity by revenue administrations. In fact, by controlling for differences in revenue administration compliance activity, it is possible to use tax compliance gap estimates to provide an insight into the effectiveness of that activity. However, any tax gap estimates must acknowledge that the relationship between compliance activity and tax compliance gap is complex and multifaceted which will have tax, transfer and economic effects. Moreover, it would also highlight that zero tax gap will never be a revenue administration objective because not only is it not possible but in particular, as the ATO Commissioner elegantly put it, ‘We know however, we can’t simply audit our way to success’ (Jordan, 2017). Even if it could, an inevitable consequence would be that if it forced unregistered small businesses to comply with their (income and expenditure) tax obligations, this might simply result in those businesses ceasing operation and its principals and employees possibly moving onto and becoming dependent on government transfers in contrast to being independent of both the tax and transfer system as before. In this case, tax gaps for a number of taxes

¹⁹ See also discussion in Toro et al. (2013, p. 17).

might be reduced but the cost might be no increased tax revenue and increased government transfer payments (as noted in section 3.3).

Containing the scope and suitably qualifying any tax gap estimates made is therefore a major challenge for those undertaking such analysis. A strategic response here might be to focus only on tax *compliance* gap with current policies and attempt to contextualise tax compliance gap estimates over time based on the classification in Box 2. If a digital era then led to pressures and tax compliance gap estimates revealed evidence of broad non-compliance, then this might be enough of an indicator that tax system integrity is being compromised and that government must acknowledge the threats posed to tax integrity and tax design sustainability – even without undertaking tax policy gap analysis.

If non-compliance appeared to arise from sectoral behaviour (Box 2), then a strategy here might be to measure tax compliance gap not by tax but by economic agents such as individuals or firms. This way, the source of non-compliance can be more directly and comprehensively linked to its origins such as taxpayer behaviour (and their advisers) more generally rather than response to a tax in particular. This would also highlight when measuring tax gap that the base of each tax is a composite and that different taxes on the same taxpayer are related because their activities are interrelated. Such analysis could also result in consideration of non-compliance with negative taxes administered by other administrations such as social transfer payments, tax expenditures or subsidies, regardless of level of government.

A comprehensive taxpayer-based approach to tax gap would also highlight how compliance action on one tax impacts other taxes with, for example, action on personal income tax compliance impacting compliance in Australia with the Medicare levy/surcharge; Higher Education Loan Program (HELP) repayments; Income Tax Pay-as-you-go (PAYG) instalments; income deduction claims; superannuation guarantee charges; self-managed superannuation fund income and expenses; micro-small businesses; payroll tax liability; and workers compensation payments.

In an effort to provide different perspectives on the same issue, the HMRC (2017, pp. 4-5) prepares an overall tax compliance gap (as a nominal and as a percentage of tax liabilities) along with its distribution between consumer groups, by tax and by behaviour. Estimating tax gap at the individual level across taxes would also better facilitate understanding of taxpayer variation by income (and its composition), expenditure, behaviour (including non-observed), spatial, intertemporal (including time shifting of income) and demographic (such as age) factors. All this is separate from considerations related to revenue administration which can involve data systems management, data warehousing and data analytics.

In the case of Denmark, the Danish Tax and Customs Administration (SKAT) has undertaken income tax gap estimation using bottom-up random audit-based approaches (Pedersen, 2017; Thackray, Hutton & Kapoor, 2015a). What random audits have enabled SKAT to do is quantify tax compliance problems which previously were only able to be qualified, typically anecdotally. For SKAT this meant that tax gap estimation provided not only an insight into its overall performance and into resource allocation decisions but also helped address political questions about the effectiveness and fairness of the current tax system. Tax gap has therefore enabled (along with associated random

audits) SKAT²⁰ a basis on which to propose and draft new legislation designed around compliance data and with enhancing the planning process and enabling evidenced-based actions.

Clearly, the great strength of tax gap analysis is that it enables quantification of what is too often only able to be qualified, facilitating a move from actions too often based only on anecdotal evidence, to those which are evidence-based and where policy responses are capable of direct assessment in terms of their performance relative to objective.

As the digital era impacts on every aspect of not only the tax system but the broader economy, tax gap analysis because of its broad ranging ambit will have the advantage of enabling a quantification of what was previously qualified and therefore facilitate evidence-based policy responses to be developed and implemented.

3.7 Normative aspects of tax compliance gap

What the above discussion has highlighted is the importance of the estimating of tax gap to a holistic understanding of how economic challenges such as the digital era impact tax system integrity and tax policy design sustainability. This focus on the positive question of ‘what is’ inevitably raises the normative question of ‘what ought to be’ the tax gap and why, and what should be the response. The problem is that tax integrity has many stakeholders and for each, interest in this issue arises for widely varying reasons. As shown in Figure 13, the different perspectives of stakeholders will result from different interpretations of their causes and, inevitably, tensions will arise between stakeholders as to solutions because their interests are often in conflict. For example, while a lack of integrity worsens equity, integrity failures have beneficiaries who will resist change including agitating politically for their benefits to be maintained.

Fig. 13: Stakeholders in Tax Compliance Gap

Stakeholder	Why the interest in tax gap	What is tax gap to them
Treasury	Tax policy design	Policy issue
Revenue administration	Tax integrity	Compliance issue
Taxpayers	Tax equity/fairness	Behavioural issue
Politicians	Community perceptions of fairness and reluctance to pay taxes	Voter concern
Official statistician	Reliability of data drawn from taxation statistics	Data reliability

Source: author.

²⁰ See section on ‘From Tax Gap to Action’ in Pedersen (2017, p. 13).

Fig. 14: Digital Era Tax Integrity Challenge and Tax Gap

		INTEGRITY					
		TAX POLICY	TAX ADMINISTRATION			CONTEXTUALISATION	
INPUTS	POLICY DESIGN INTEGRITY	COMPLIANCE INTEGRITY (eg Staff capability)	DATA INTEGRITY (eg own and 3 rd Party)	SYSTEMS/ PROCESSES INTEGRITY eg data warehouse/analytics	MICRO-ECONOMY (eg taxpayer behaviour)	MACRO-ECONOMY (cycle, structure (NOE/ OE))	
	'NORMATIVE' POLICY ('What ought to be')						'CURRENT' POLICY ('What is')
OUTCOME GAP BASED MEASURES	Policy Gap	Compliance Gap (CG)		Compliance Outcomes	Disaggregated outcome by: taxpayer, behaviour, time, component, demographic, spatial, socio-economic attributes		
	Tax Efficiency Gap	Assessment Gap	Collection Gap				
RELATED OUTCOME MEASURES	Tax Expenditure Gap	Net Tax Gap (NTG)					
		Gross Tax Gap (GTG)					
RELATED OUTCOME MEASURES	VAT Revenue Ratio T^{AP}/tE and c-efficiency $(1-\beta) \cdot (1-\Gamma)$	Total revenue effects	Audit yield	NOE, Unregistered OE	%NOE	Statistician measures	
	Tax Expenditures	Revenue/FTE	Tax Assured		Deadweight Loss		
		VCR T_v/T^{TL}	NCR G^N/T^{TL} and CG/T^{TL}	TVCR n/n	Compliance cost C	% Non compliance	
		Compliance Gap Ratio $I=T^{TL}/T^{TL}$	Policy Gap ratio $P=T^{TL}/T^*$	Avoidance tax gap	TG Components TG^C/TG		
		Administration cost A	Non-observed economy	Non-detection error			

Notes

TG^C	Percentage tax gap by component: The component can relate to sources of non-compliance such as <i>E</i> , <i>D</i> , and <i>R</i> differences or demographic or geographic factors. Such a measure could also monitor spatial Intensity of non-compliance when applied across locations ²¹
$TVCR$	Taxpayer Voluntary Compliance Ratio is proportion of taxpayers who voluntarily comply with their obligations (<i>n_v</i>) relative to the population of all taxpayers (<i>n</i>) ²²
DWL	Deadweight loss is the welfare cost of distortions arising from imposition of taxes
VRR	VAT Revenue Ratio (<i>VRR</i>) (see OECD, 2016) is GST/VAT revenue ratio = $T^{AP}/t.F$ where <i>t</i> = GST/VAT standard rate, <i>F</i> is domestic household final consumption expenditure and T^{AP} is GST/VAT revenue collected.
c-efficiency	Reflects compliance gap and policy gap (Keen, 2013) and is related to GST/VAT Revenue Ratio (<i>VRR</i>)
<i>A</i>	Administrative cost for the revenue administration
<i>C</i>	Compliance cost of taxpayer
Tax Assured/ Justified Trust	OECD has indicated that 'Tax assured measures the proportion of the tax base where the revenue administration has 'justified trust' through its activities or others' activities that tax is 'under control' and so assured as accurate and paid', where 'This approach aims for the right tax to be paid at the right time so that the revenue administration has justified trust in the tax return rather than needing to audit by default' (see OECD, 2014, pp. 51 and 18 respectively).
<i>VCR</i>	Voluntary Compliance Rate is T^V/T^{TL} or, defined as 1 minus the ratio of the gross tax gap to total liabilities
<i>NCR</i>	Net Compliance Rate is defined as 1 minus the ratio of the net tax gap to total liabilities (Black et al., 2012).

Source: author.

This could result in political pressure on revenue administration funding and increased parliamentary scrutiny of their actions. This is particularly important if for some reason, revenue administrators saw reduced political scrutiny of its compliance activities (such as calls to explain taxpayer compliance actions or appearances before parliamentary committees) as relevant (which it should not be) performance indicators. Tax

²¹ An estimation of percentage tax gap (PTG) across regions was undertaken for Italy in Carfora, Pansini and Pisani (2016). Regional differences in tax gap were also examined in Briaiotta et al. (2015).

²² See concept as applied by ATO at: <https://www.ato.gov.au/about-ato/research-and-statistics/in-detail/tax-gap/previous-years-analysis/tax-gap-methodology-2015-16/?page=3>.

compliance gap may also be an issue for the official statistician inasmuch as data concerns arising from tax gap estimation by the revenue administration might have implications for official statistics as occurred in the UK as a result of carousel fraud impact on VAT collections and therefore VAT gap (Ruffles et al., 2003)..

A relevant and important question raised by tax gap studies is ‘How much tax gap is acceptable?’ and by implication, what non-compliance with current tax obligations would be broadly acceptable? Any response must inevitably countenance not only issues such as the cost-benefit decisions by revenue administrators, but what are accepted behavioural norms by taxpayers and what is the preferred tax design. These are all critical issues for consideration as the increasing digitisation of the economy will act to challenge many established principles and approaches and therefore challenge tax integrity and sustainability.

Clearly, ‘How much tax gap is acceptable?’ is akin to asking ‘How much tax integrity is acceptable’, of which the corollary is ‘How much revenue administration compliance activity is enough?’ A problem is that tax compliance gap has two fundamental components – frequency and level. ‘High non-compliance by a few’ may result in the same tax compliance gap outcome as ‘low non-compliance by many’. Clearly the same response in each case would not be justified and, in the latter case, no amount of enforcement is likely to address the tax gap (in contrast to the former) with the only solution being a policy redesign response. However, where there is ‘high non-compliance by a few’ then compliance actions will be more effective and a policy response will be potentially unnecessary.

While tax gap estimates can inform as to the sources and causes of non-compliance, other measures must complement these. However, what Figure 14 illustrates is that tax gap-related measures can assume a central role in informing as to all aspects of the performance of the administration and design of the tax system. Not only does tax compliance gap highlight issues arising from compliance outcomes and potential tax revenue from current policy arrangements, it raises important questions about the integrity of inputs into those outcomes such as data, systems and processes (which are particularly crucial to bottom-up tax gap estimates). Moreover, since tax gap is more than just tax compliance gap, closely monitoring the relative differences over time between the tax definitions in Figure 12 is important to understanding the sources of tax gap (noted in Box 2). This can also inform redesign of current policies focused on addressing tax integrity and sustainability and bring into question whether current policy is what it ought to be (normative policy) and whether some alternative policy design or revenue administration would improve overall tax system integrity. Through the measurement of tax gap, greater transparency and accountability can be brought to a host of issues fundamental to tax policy design and administration.

4. TAX GAP INSIGHTS INTO DIGITAL ERA ‘WHAT IF’ CHALLENGES: A STAKEHOLDER-BASED ANALYSIS

To highlight how undertaking tax gap analysis can forewarn and therefore forearm revenue administrators and policy-makers facing rapid change and escalating risk arising from the digital era, a series of possible ‘what if’ scenarios will be examined in this section from the perspective of different stakeholders. Included here will be the revenue administration which is assigned responsibility for administering the current tax system and the Treasury or Ministry of Finance, which is responsible for advising government on the system design. Attention will also be given to those agencies who

might use data collected by the revenue administration (such as the official statistician) or who use and collect comparable information as with those responsible for administering the welfare system and retirement incomes policies or compiling official statistics. As will be evident, the data demands of tax gap when including both tax compliance gap and tax policy gap have the profound benefit of asking all the right questions, even if it cannot provide the answers.

4.1 ‘What if’ issues for the revenue administration

In this section some of the anticipated outcomes from a pervasive digital era will be examined for how tax gap can provide evidence-based insights to the revenue administration to facilitate its greater readiness to respond to trends and likely outcomes. In the process it will be evident that estimating tax gap brings with it not only greater transparency to its activities but also accountability for how expenditure is made and what actions are taken to assess and mitigate risk.

4.1.1 *What if the black economy is 3% in a digital era?*

In the Australian national accounts, the black economy is assumed to be equivalent to 1.5% of GDP (Australian Bureau of Statistics, 2013). The basis of this estimate is data derived largely from the ATO over two decades ago. If tax compliance gap analysis undertaken using the top-down approach uses Australian Bureau of Statistics (ABS) national accounts data, then not only is any top-down approach not independent of a bottom-up approach to measuring tax compliance gap (which might detect non-compliance and therefore the black economy) but also it may be impacted because the estimate of 1.5% may simply not be correct. If for example the size was more like 3%, then there would be a greater difference between tax compliance gap estimates using the bottom-up approach as against the top-down approach. Independence of the two different sources on which tax compliance gap estimates are undertaken under each of the approaches is critical to the integrity of any findings.

4.1.2 *What if data access tomorrow is nothing like that today?*

With digitisation of all aspects of the economy and society comes far greater access to data on all entities and their actions than was possible until quite recently. The rise of data warehousing, data analytics and computational power is offering up significant opportunities for revenue administrations to undertake tax gap analysis and thereby gain insights into tax system integrity and policy design threats. By complementing tax compliance gap insights with knowledge gained from the application of artificial intelligence-based data systems, revenue administrators will in the future have available powerful tools for ensuring monitoring and responding to tax integrity and design challenges.

4.1.3 *What if a high proportion of income reported in tax returns has no third party checks?*

While pre-population of tax returns for income data is now common in most personal income tax systems, the lack of third party data on business income and deductions is a well-known and major weakness in the tax system (Warren, 2016a). In Australia, individuals in 2014-15 received unverifiable business income of around 13% of their

total income²³ and claim deductions for which there is no third party reporting equal to 4.4% of all income. In the case of small businesses operated by individuals, there is almost no third party reporting of income and expenditure which offers up substantial scope for small businesses to under-report income (as with cash transactions) and over-report expenses (such as when expenses are actually personal). This lack of third party verification of some income and deductions has obvious implications for personal income tax gap estimates. As Kleven et al. (2011, p. 676) found in the case of Denmark, ‘variables that capture information (such as the presence and size of self-reported income, self-employment, audit flags, and prior audit adjustments) have very strong effects on tax compliance [which] confirms the conclusion that information and traceability are central to the compliance decision’.

If a digital era brings with it more small business opportunities through its encouragement to individuals to become business owners or for wage and salary income to be supplemented with micro business activity, then undertaking tax compliance gap estimates has the potential to bring to light real and substantial challenges to personal income tax integrity from the digital transformation.

4.1.4 *What if the risk-differentiation framework does not work?*

The ATO states that:

Small business benchmarks are a guide to help you compare your business’s performance against similar businesses in the same industry....The easiest and quickest way to see how your business compares to competitors is by using the business performance check tool.²⁴

However, benchmark ratios are not independent of non-compliance and while this might not be an issue if non-compliance is the exception, if non-compliance is the rule then benchmark ratios could propagate continued non-compliance.

If risk differentiation is framed around deviation from benchmark ratios then endemic non-compliance will not be captured using this framework and widely prevalent ‘unknown-unknowns’ will continue to remain unknowns. A bottom-up tax compliance gap study could provide a circuit breaker and address this endogeneity risk in the benchmark ratios, especially where the tax gap study is based around random audits which will independently challenge what is understood as a known. A further advantage of undertaking these random audits is that they will inform the revenue administrators as to risks emerging from the digital era. This will enable a proactive response to risk, rather than a reactive (lagged) response based on identifying issues with lodged tax returns.

4.1.5 *What if tax gap highlights broad-based non-compliance?*

If taxpayers do not comply with their tax law obligations, then tax compliance gap estimates will reveal evidence on non-compliance. However, if this non-compliance arises from *all* taxpayers not complying a *small* amount, then not only does the revenue

²³ ATO, ‘Taxation statistics 2014-15, individuals’, <https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Taxation-statistics/Taxation-statistics---previous-editions/Taxation-statistics-2014-15/?anchor=Individuals#IndividualsSummarytables>.

²⁴ ATO, ‘Small business benchmarks’, <https://www.ato.gov.au/Business/Small-business-benchmarks/> (accessed 30 January 2019).

administration have a tax integrity issue, so too does tax system design. This is because no revenue administration can audit every taxpayer. In this case the solution might not be with audit but with changes to tax design or with mandating taxpayers' use of officially sanctioned software or systems. If, for example, tax compliance gap analysis indicated that work-related expenses were over-claimed by individual taxpayers, one extreme solution might be to change the tax policy and abolish such deductions. Another extreme solution might be to require taxpayers to record all deductions claimed in some officially sanctioned software such as in ATO *myDeductions*.²⁵ An intermediate and politically more attractive solution might simply be to change policy to limit deductions (Warren, 2014).

Using tax compliance gap analysis for verification combined with policy and administration reforms design to address the current lack of third party data reporting offers up a potential strategy designed to strengthen the revenue administration's capability in the future.

4.1.6 *What if tax gap is about socio-economic, demographic, spatial, immigration or regulatory issues?*

Assessing tax gap based around its sources may need to take more than simply an economic focus and also incorporate consideration of how it might vary between different social, demographic and geographic groups as behaviour might simply not be related only to income but to a range of other important factors. Any component analysis of tax gap must therefore incorporate consideration of a diverse range of factors rather than simply the economic. However, as Slemrod (2007), Allingham and Sandmo (1972) and Sá, Martins and Gomes (2014) all highlight, the complex interaction of many factors results in substantial heterogeneity in tax evasion with patterns often unique rather than systematic. The conclusions in the study by Kleven et al. (2011, p. 676), noted in section 4.1.3 above will also be relevant here.

4.1.7 *What if the cause of tax gap lies not with taxpayers by their advisers?*

While the focus of tax gap is typically on the taxpayer, further relevant questions are, what if the taxpayer's behaviour is directly related to professional advice and what if that professional advice is the source of non-compliance? In this case, pursuit of the individual for non-compliance is not the root cause of the problem; rather it lies with their advisers. In a recent presentation the Australian Commissioner of Taxation Chris Jordan stated that:

For years I've heard how tax agents were guardians of the system – these random enquiry results tell me this is not the case for some agents. They are not fulfilling their duty as a registered tax practitioner in line with the Tax Practitioners Code of Conduct (Jordan, 2018).

This conclusion arose as a direct result of the ATO random enquiry program undertaken as part of the ATO personal income tax gap estimation.²⁶

²⁵ ATO, 'Online services: myDeductions', <https://www.ato.gov.au/General/Online-services/ATO-app/myDeductions/> (accessed 30 January 2019).

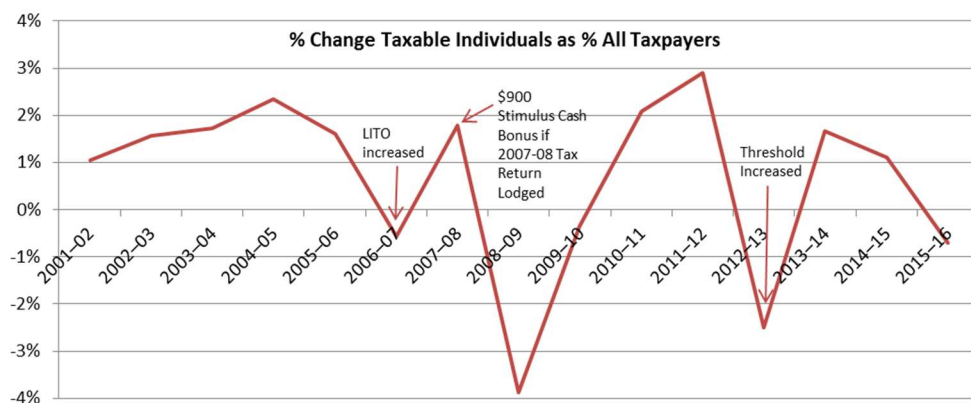
²⁶ For *Individuals not in business*, the ATO observed from its personal income tax gap related random enquiry program that 'incidence of adjustment was 72%, with 78% of agent-prepared returns being adjusted. This is compared to 57% of returns adjusted for people who prepared their own tax (self-

A major benefit of tax gap studies is therefore that the pursuit of an explanation for behavioural responses by taxpayers in regard to a particular tax may lead to answers beyond that taxpayer and might in fact raise issues that relate to more than that particular tax. After all, if a tax adviser is engaged in encouraging and facilitating income component non-compliance then they might also be engaged in non-compliance in relation to non-income taxes. What tax gap studies therefore enable is an evidence-based approach to issues rather than anecdotal or rhetorical assertions which lack substance. As noted in section 3.6 for Denmark, tax gap estimation has provided SKAT with evidence-based responses to non-compliance which previously were not readily available, just as the Australian Commissioner has used evidence gathered through the tax gap-related random enquiry program to argue that registered tax agents need to demonstrate rather than assert that they are the guardians of the tax system.

4.1.8 What if 1 million personal income taxpayers 'go missing' using new digital era technology?

The global financial crisis (GFC) in 2007-08 precipitated a major upheaval in many aspects of individual lives and previously established institutions and their reputation became questioned, especially financial institutions, along with confidence in the market economy. Since then and combined with the growth of the digital era, there is trend evidence that has important implications for tax compliance gap which is as yet not fully understood.

Fig. 15: Disappearing Income Taxpayers Receiving Stimulus Cash Bonus



Source: ATO, *Taxation statistics 2014-15* (2017).

One trend is shown in Figure 15 which outlines the annual percentage change in the number of taxpayers over the period 2001-02 to 2014-15. While the number of taxpayers fell as a consequence of two changes in the effective tax rate threshold (in 2006-07 and in 2012-13), the availability of a \$900 grant in 2009 conditional on the lodgement of 2007-08 tax returns contributed to 223,220 extra taxpayers lodging returns in 2007-08, but in 2008-09, the number of taxpayers fell by 501,160. Clearly a large number of taxpayers lodged tax returns for 2007-08 with twice as many then removing themselves from the system even though they probably were effectively still liable for tax. The fiscal impact of this on tax compliance gap is not immediately clear because it

preparers)'. See ATO, 'Individuals not in business income tax gap', <https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/Individuals-not-in-business-income-tax-gap/> (accessed 30 January 2019).

is possible that many of these taxpayers might have received refunds which they previously had not claimed. However it is equally likely they are in receipt of other income sources, particularly cash wages for which additional tax is due.

Another personal income taxpayer trend post-GFC of concern is that demonstrated in Table 1. This Table shows that in the seven years to 2014-15, over 500,000 young people, relative to the base year of 2007-08, were no longer taxpayers, all at a time when the casualisation of the workforce would imply that the opposite should be the case. If the trends in Figure 15 and in Table 1 are in any way related to, or potentially reflective of, how the digital era is impacting economic activity, then a personal income tax gap study could help in highlighting whether these two trends are related to non-compliance (or not) such as a response to an economic environment where increased market competition and increased opportunity has encouraged employers to avoid their tax responsibilities under the law in an effort to minimise costs.

Table 1: Explaining the Unknown: Case of the Disappearing Young Taxpayers

	Age			18-24yo		
	2007-08	2011-12	2014-15	2007-08	2011-12	2014-15
Taxpayers as % of Population Age Group* (A)	39.9%	22.1%	17.2%	84.2%	75.2%	71.1%
Taxpayers (000s) (B)	341,295	191,362	148,453	1,784,290	1,674,962	1,629,356
Taxpayers if (A) from 2007-08 applied (C)	341,295	344,720	343,966	1,784,290	1,876,441	1,930,517
Difference: Disappearing Young Taxpayers (C-B)	-	153,358	195,513	-	201,479	301,161

* It is assumed in this calculation that taxpayers under 18yo are in the 15-17yo population grouping.
Source: Own computations and ATO, *Taxation statistics 2015-16* (2018), Individuals Income Tax Rates Data Sources, <https://data.gov.au/dataset/d170213c-4391-4d10-ac24-b0c11768da3f/resource/c8c30757-dcf6-4c4c-9c2c-783b61390266/download/taxstats2016snapshot01historicalratesofpersonalincometax.xlsx>;
ABS, *Australian demographic statistics, Jun 2017, Cat. 3101.0* (2017), <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Jun%202017?OpenDocument> ;
ATO, *Taxation statistics 2015-16* (2018), Individuals Table 1, <https://data.gov.au/dataset/d170213c-4391-4d10-ac24-b0c11768da3f/resource/c4ac2c65-7e0c-49bb-adc2-356356a03ab1/download/taxstats2016individual01byyear.xlsx>.

4.2 ‘What if’ issues for Treasury or the Ministry of Finance

4.2.1 What if individual income tax gap is related to tax policy design?

There is every likelihood that in undertaking a tax compliance gap study, addressing non-compliance is beyond the capability of the revenue administration. If for example endemic non-compliance exists as a result of the lack of third party data on exempt income and deductions (as noted above), then the only feasible solution might be a change to the policy design. Since this is not a responsibility of the revenue administration, it must ultimately fall to Treasury or the Ministry of Finance given the advice from the administration, to redesign the policy to address the issue revealed by the tax gap study. With the ascent of the digital age, this might mean the need to redesign how deductions are (or are not) accessed by taxpayers. In the case of the goods and services tax (GST), it might mean that non-compliance arising from the base exemptions and the application of concessional rates can only be addressed through adopting a more comprehensive base avoiding boundary issues between categories where tax rate differentials exist.

4.2.2 *What if small business non-compliance is related to business concessions?*

Small businesses have available to them a raft of tax expenditures such as accelerated depreciation or special deductions or concessional tax rates. What results is differential rates of taxation on business income because of these taxpayers accessing such tax expenditures. When non-compliance arises from abuse of these tax expenditures which is beyond effective monitoring by the revenue administration, only a policy response can address the issue. The tension here however is that tax expenditures typically arise in a political environment and are often designed conceptually by Treasury or the Ministry of Finance with inadequate attention to enforcement and monitoring by the revenue administration. This disjunction between idea, concept and its application will be highlighted by tax compliance gap and potentially also by tax policy gap analysis.

4.2.3 *What if tax compliance gap reveals non-compliance is pervasive but low level?*

Tax gap analysis can also highlight fundamental problems for tax design which are not capable of resolution either through revenue administration or tax policy design. This is the case for example if there is evidence of significant non-compliance in micro-businesses (related to cash) or income components (like rental income) that cannot simply be resolved. In this case, resolution might lie in other non-tax-related action such as moving to a cashless economy to address cash-related non-compliance or improvements to third party reporting of all income (as also discussed above).

4.2.4 *What if tax compliance gap is counter-cyclical and does not fully cycle on recovery?*

While tax gap at a point in time might be interesting, what is particularly informative (given the limitations of the methodology typically adopted) is trends in tax gap and its component parts. For example, if a consistent methodology and common data are adopted in a time series study, it might be possible to understand how compliance activity by the revenue administration impacted tax gap or how the economic cycle (and therefore a range of economic variables) impact over time. The latter is particularly important in the context of the digital era because tax gap offers the opportunity when framed both in top-down and the bottom-up approaches to put in place necessary checks to ensure the revenue administration has appropriately contextualised the challenges a digital era imposes on its responsibilities.

4.2.5 *What if compliance actions (or policy change) by a revenue administration to reduce tax compliance gap are detrimental to the economy?*

A further benefit of tax gap analysis is that it can potentially highlight how any attempt to reduce the tax compliance gap might impact the overall level of economic activity and therefore not only tax- but also non-tax-related aspects of government responsibility (as evident in Figure 11). For example, if tax compliance gap arose from the cash economy then efforts to reduce it might not increase revenue but simply reduce economic activity and increase government expenditure on transfer programs.

Estimating tax efficiency gap and tax expenditure gap along with tax compliance gap also highlights (Figures 2 and 3) how tax design impacts beyond the observed to the non-observed economy and to the distortions arising from taxes in general.

4.2.6 *What if a tax compliance gap estimate was to accompany a regulatory impact statement?*

A regulatory impact statement²⁷ typically accompanies proposed legislative changes and involves a process for assessing the broad impact across various stakeholders of the impact of some change to policy or regulation (Council of Australian Governments, 2007). Clearly, tax compliance gap analysis accompanying such a statement would provide useful quantitative and qualitative insights into the impact of any change framed around T^{TL} and T^* .

4.3 ‘What if’ issues for the Official Statistician

4.3.1 *What if tax compliance gap implies that assumptions in official statistics need changing?*

As noted above, tax compliance gap estimates can bring into question various aspects of official statistics, particularly where those statistics form the basis of a top-down approach to estimating tax gap. For example, if the non-observed economy is assumed to be much smaller in official statistics than is observed as a result of a bottom-up tax compliance gap study then the official statistics will need revision. This was the experience in the UK as a result of taking into account carousel fraud associated with the VAT and its impact on trade statistics (Ruffles et al., 2003) and has resulted in UK being in dispute with the EU over compensation payments to the EU for lost customs duties claimed to be the result of negligent UK customs enforcement in addition to the VAT revenue also lost to national governments in this case themselves (Rankin, 2017). Clearly VAT Compliance Gap is important not just to HMRC but to the EU and to the UK Office of National Statistics. All government statisticians clearly have an interest in tax compliance gap because it has direct implications for the integrity of national accounts data and size of non-observed economy.

If for example the non-observed assumption as a result of undertaking a tax compliance gap study using a bottom-up approach finds that it is 3% of overall economic activity rather than 1.5% and that over time the non-observed economy has been increasing, then the government statistician has an issue with the integrity of national accounts data over time which could go some way to explaining those aspects of national accounts data derived as residuals such as household savings, and help explain low rates of growth in the observed economy when most growth has occurred in the non-observed economy.

4.3.2 *What if wages are under-reported?*

How wages and salaries are measured and reported is a fundamentally important variable to several aspects of government policy and to the cost of government.²⁸ What

²⁷ Department of the Prime Minister and Cabinet, ‘Regulation impact statement updates’, <https://ris.pmc.gov.au/>.

²⁸ The Australian Bureau of Statistics (ABS) estimates Male Total Average Weekly Earnings (MTAWE) from survey based data and is used as the foundation upon which pensions are indexed (linked to 27.7% of MTAWE: Klapdor, 2014), and Average Weekly Ordinary Time Earnings (AWOTE) is linked to various superannuation-related tests: ATO, ‘Key superannuation rates and thresholds, Average weekly ordinary time earnings’, <https://www.ato.gov.au/Rates/key-superannuation-rates-and-thresholds/?page=40> (accessed 30 January 2019). When the ABS changed how often and when it published AWE estimates, the Treasury in 2013 released a paper on related legislative change which necessarily accompanied this change, serving to demonstrated the wide use of AWE-related measures (Australian Treasury, 2013). If estimates of AWE, MTAWE, and AWOTE and in turn of ABS estimation of Compensation of Employees (COE) are found as a result of tax gap estimation to not fully reflect

if a bottom-up tax compliance gap study revealed that the digital era is enabling significant wage and salary non-reporting? Such under-reporting not only impacts tax integrity, but the integrity of official survey findings on average wages and salaries and for the compensation of employee value included in the national accounts data. Correct reporting of wages and salaries has implications well beyond tax such as where it is used to index transfer payments or income tax thresholds.

4.3.3 *What if personal and business expenses are blurred?*

If a bottom-up tax compliance gap study reveals private expenses are being claimed as a deduction against business income, this not only has implications for personal and business income tax revenue but also for the related aggregates in the national accounts including gross mixed incomes (ABS, 2013), intermediate inputs into business, final expenditure by households and capital expenditure by businesses.

Tax gap analysis clearly asks many questions and, undertaken comprehensively, has the potential to provide the evidence base for not just better revenue administration but better tax policy design and improved official statistics.

4.4 **‘What if’ issues for other non-revenue administrations**

Tax gap analysis and related estimates have implications beyond just tax to include any administrator whose programs or activities are dependent on data (e.g., income) impacted by the tax gap findings. If the digital era has meant that there is a growth of employment in the black economy and this is revealed by the tax compliance gap estimates, then this has implications for government transfer payments which are income contingent such as those administered by Centrelink in Australia (income matching and indexation to wages and prices: see Department of Human Services, 2019), repayment of income contingent loans such as the Australian Higher Education Loan Program (HELP), State (subnational) government utility concessions related to pension receipt, superannuation-related thresholds, and bank-related loans repayments. Tax gap analysis might also highlight issues such as carousel fraud under the GST as noted above which have obvious implications for border protection as would tobacco and alcohol tax gap.

What should not be lost also is that tax gap has relevance at all levels of government. Estimation of tax gap associated with taxes such as land tax and payroll tax are important in Australia to subnational governments. Equally, tax gap estimated at a national level can have direct implications for tax gap associated with subnational taxes. After all, observations about non-compliance for personal income tax, with pay-as-you-go withholding or superannuation contributions at the national level have implications for tax gap of a payroll tax when imposed at the subnational level.

5. **BE PREPARED TO BE CHALLENGED – TAX GAP ANALYSIS QUESTIONS EVERYTHING!**

This article argues that measuring tax gap is capable of highlighting ‘everything’ a digital era might mean for tax – and not just tax non-compliance. Since tax gap measures the difference between the theoretical tax liability and actual revenue collected, estimating tax gap raises both normative and positive questions about tax. Normative

AWE, then this has direct and significant fiscal implications for many agencies and individuals. (For ABS Survey description, see ABS, 2018, explanatory notes.)

because it raises questions about ‘what should be’ collected – a policy design question – and ‘what ought to be’ collected – a legal question – and contrasts this with the positive question of ‘what is’ actually collected. Contrasting ‘what should be’ (T^*), ‘what ought to be’ (T^{TL}) and ‘what is’ (T^{AP}) can be provided through tax gap analysis.

What tax gap estimates can therefore do is transparently link tax policy design, revenue administration performance and taxpayer behaviour to the broader questions of economic growth, fiscal sustainability (or funding government) and fiscal effort and capacity. Tax gap also raises issues about the spatial (e.g., regional), temporal (e.g., time trends) and compositional (e.g., varying behaviour across groups) aspects of tax. It also asks fundamental questions about data and its integrity as reported by the revenue administration and the official statistician (such as the treatment of the black economy). It can also provide insights into issues with economic, social, political and institutional origins.

Being forewarned about future risks to revenue arising from a digital era is critical to maintaining a robust and sustainable tax system from both a compliance and design perspective. However, the confronting nature of findings from tax gap studies should not be underestimated, especially when compliance gap reveals a divergence between community rhetoric and reality on non-compliance or where policy gap provides evidence on the cost of adopting policy designs which are in the interest of selected stakeholders and not in the broader community interest.

Crucially, what tax gap estimation cannot do is provide answers, but rather only insights into problems and challenges such as its impact on taxpayer non-compliance behaviour, on revenue administrator effectiveness, and on integrity of national account statistics including growth in the black economy. Responses must come through policy, legislative, administrative and other changes. Nonetheless, tax gap estimation can be the catalyst for bringing transparency, understanding and evidence-based responses to otherwise complex issues arising through the onset of the digital era.

As more countries build their capacity to undertake tax compliance gap estimates and those studies become publicly available (and part of official statistics), greater transparency and evidence-based discussion will be brought to the tax challenges that economic transformations like the digital era bring. While tax gap estimation is clearly just one part of the process of improved tax policy review and reform in response to the digital era, it is one that is still in its infancy but with the potential to highlight how tax is connected to every aspect of the economic and social well-being of a country and its citizens.

6. REFERENCES

- Allingham, M G & Sandmo, A 1972, ‘Income tax evasion: A theoretical analysis’, *Journal of Public Economics*, vol. 1, nos. 3-4, pp. 323-338.
- Auditor-General, New South Wales 2015, *Efficiency and effectiveness in tax collections: Performance audit*, Office of Finance and Services, Office of State Revenue, Audit Office of New South Wales, <https://www.audit.nsw.gov.au/publications/latest-reports/efficiency-effectiveness-tax>.

- Australian Bureau of Statistics (ABS) 2013, 'The non-observed economy and Australia's GDP, 2012', information paper, Cat. 5204.0.55.008, 12 September, <http://www.abs.gov.au/ausstats/abs@.nsf/Products/5204.0.55.008~2012~Main+Features~Comparison+of+Results?OpenDocument>.
- Australian Bureau of Statistics (ABS) 2018, *Average weekly earnings, Australia, May 2018*, Cat. 6302.0, Canberra, 16 August, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/7F76D15354BB25D5CA2575BC001D5866?opendocument>.
- Australian Taxation Office (ATO) 2017, *ATO corporate plan 2017-18*, Canberra, https://www.ato.gov.au/uploadedFiles/Content/CR/downloads/n7769_08_2017_js39469.pdf.
- Australian Treasury 2013, 'Impact on tax and superannuation provisions indexed to average weekly ordinary time earnings: Proposals paper', Canberra, April, <https://treasury.gov.au/consultation/impact-on-tax-and-superannuation-provisions-indexed-to-average-weekly-ordinary-time-earnings/>.
- Black, T, Bloomquist, K, Emblom, E, Johns, A, Plumley, A & Stuk, E 2012, 'Federal tax compliance research: Tax year 2006 tax gap estimation', Internal Revenue Service Research, Analysis and Statistics Working Paper, Washington, DC, March, <https://www.irs.gov/pub/irs-soi/06rastg12workppr.pdf>.
- Braiotta, A, Carfora, A, Pansini, R V & Pisani, S 2015, 'Tax gap and redistributive aspects across Italy', Italian Revenue Agency discussion topics N. 02/2015, https://www.researchgate.net/publication/275949809_Tax_gap_and_redistributive_aspects_across_Italy.
- Canada Revenue Agency (CRA) [2016], *Tax gap in Canada: A conceptual study*, <http://www.cra-arc.gc.ca/gncy/tx-gp/Tax%20Gap-eng.pdf>.
- Canada Revenue Agency (CRA) [2017], *Tax assured and tax gap for the federal personal income tax system*, Ottawa, <https://www.canada.ca/en/revenue-agency/corporate/about-canada-revenue-agency-cra/tax-canada-a-conceptual-study/tax-assured-tax-gap-federal-personal-income-tax-system.html>.
- Carfora, A, Pansini, R V & Pisani, S 2016, 'Spatial dynamics in tax gap determinants', Italian Revenue Agency discussion topics N. 01/2016, https://www.researchgate.net/publication/293483341_Spatial_Dynamics_in_Tax_Gap_Determinants.
- Center for Social and Economic Research (CASE) (in consortium) 2018, *Study and reports on the VAT gap in the EU-28 Member States: 2018 final report*, TAXUD/2015/CC/131, Institute for Advanced Studies, Warsaw, 11 September, https://ec.europa.eu/taxation_customs/sites/taxation/files/2018_vat_gap_report_en.pdf.
- Council of Australian Governments 2007, *Best practice regulation: A guide for ministerial councils and national standard setting bodies*, https://www.pmc.gov.au/sites/default/files/publications/COAG_best_practice_guide_2007.pdf.
- Department of Human Services [2019], *A guide to Australian Government payments, 1 January-19 March 2019*, Canberra, <https://www.humanservices.gov.au/organisations/about-us/publications-and-resources/guide-australian-government-payments>.

- Gemmell, N & Hasseldine, J 2012, 'The tax gap: A methodological review', Working Paper in Public Finance 09/2012, Victoria University of Wellington, September, <http://researcharchive.vuw.ac.nz/xmlui/bitstream/handle/10063/2435/Working%20Paper%2009.pdf>.
- HM Revenue and Customs (HMRC) 2017, *Measuring tax gaps 2017 edition: Tax gap estimates for 2015-16*, London, <https://www.gov.uk/government/statistics/measuring-tax-gaps>.
- HM Revenue and Customs (HMRC) 2018a, *Measuring tax gaps 2018 edition: Tax gap estimates for 2016-17*, London, <https://www.gov.uk/government/statistics/measuring-tax-gaps>.
- HM Revenue and Customs (HMRC) 2018b, *Measuring tax gaps 2018 edition: Methodological annex*, London, <https://www.gov.uk/government/statistics/measuring-tax-gaps>.
- International Monetary Fund (IMF) 2015a, 'Current challenges in revenue mobilization: Improving tax compliance', IMF Staff Report, Washington, DC, January, <https://www.imf.org/external/np/pp/eng/2015/020215a.pdf>.
- International Monetary Fund (IMF) 2015b, South Africa: Technical assistance report – Revenue administration gap analysis program – The value-added tax gap, International Monetary Fund Country Report No. 15/180, Washington, DC, June, <https://www.imf.org/external/pubs/ft/scr/2015/cr15180.pdf>.
- Jordan, C (Commissioner of Taxation) 2017, 'Commissioner's address to the National Press Club', Canberra, 5 July, <https://www.ato.gov.au/Media-centre/Speeches/Commissioner/Commissioner-s-address-to-the-National-Press-Club/> (accessed 30 January 2019).
- Jordan, C (Commissioner of Taxation) 2018, 'Commissioner's address to the Tax Institute National Convention 2018', Cairns, 15 March, <https://www.ato.gov.au/Media-centre/Speeches/Commissioner/Commissioner-s-address-to-the-Tax-Institute-National-Convention-2018/> (accessed 30 January 2019).
- Keen, M 2013, 'The anatomy of the VAT', *National Tax Journal*, vol. 66, no. 2, pp. 423-446.
- Klapdor, M 2014, 'Pension indexation: A brief history', *Flagpost*, Australian Parliamentary Library, 16 April, https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/FlagPost/2014/April/Pension-indexation (accessed 30 January 2019).
- Kleven, H J, Knudsen, M B, Kreiner, C T, Pedersen, S & Saez, E 2011, 'Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark', *Econometrica*, vol. 79, no. 3, pp.651-692.
- McManus, J & Warren, N 2006, 'The case for measuring tax gap', *eJournal of Tax Research*, vol. 4, no. 1, pp. 61-79.
- National Tax Agency, Sweden (Skatteverket) 2008, 'Tax gap map for Sweden: How was it created and how can it be used?', Report 2008:1B, Stockholm, February, https://www.skatteverket.se/download/18.361dc8c15312eff6fd2b9a4/1473840293366/Report_2008_1B.pdf.
- National Tax Agency, Sweden (Skatteverket) 2014, 'The development of the tax gap in Sweden 2007-12', Report 1(91), Stockholm, January, <https://www.skatteverket.se/download/18.15532c7b1442f256baeae28/1395223863657/The+development+of+the+tax+gap+in+Sweden+2007-12.pdf>.

- Organisation for Economic Co-operation and Development (OECD) 2002, *Measuring the non-observed economy: A handbook*, OECD Publishing, Paris, <https://www.oecd.org/sdd/na/1963116.pdf>.
- Organisation for Economic Co-operation and Development (OECD) 2014, *Measures of tax compliance outcomes: A practical guide*, OECD Publishing, Paris, <http://www.oecd.org/ctp/administration/measures-of-tax-compliance-outcomes-9789264223233-en.htm>.
- Organisation for Economic Co-operation and Development (OECD) 2016, 'Consumption tax trends 2016 – Australia', <https://www.oecd.org/tax/consumption/consumption-tax-trends-australia.pdf>.
- Organisation for Economic Co-operation and Development (OECD) 2018, *Tax Challenges Arising from Digitalisation – Interim Report 2018*, Inclusive Framework on BEPS, OECD/G20 Base Erosion and Profit Shifting Project, OECD Publishing, Paris, March, <http://www.oecd.org/ctp/tax-challenges-arising-from-digitalisation-interim-report-9789264293083-en.htm>.
- Pedersen, S 2013, 'Random audits in Denmark', presentation to Danish Tax and Customs Administration (SKAT), Nordic workshop on tax evasion, Stockholm, 6 March, https://ucfs.nek.uu.se/digitalAssets/238/c_238407-l_1-k_s--ren-pedersen.pdf (accessed 29 January 2019).
- Pedersen, S 2017, 'Tax gap estimation in Denmark. Why? and How?', Danish Tax and Customs Administration (SKAT) presentation, Helsinki, 9 February, https://www.vero.fi/download/Tax_Gap_Estimation_in_Denmark/%7B7F3FF1A4-A3B7-451C-91CB-BD4919BF2A40%7D/13516 (accessed 29 January 2019).
- Rankin, J 2017, 'UK faces EUR 2bn fine over Chinese imports scam, say EU investigators', *The Guardian*, 8 March, available at: <https://www.theguardian.com/world/2017/mar/08/uk-faces-2bn-fine-over-chinese-imports-scam-say-eu-anti-fraud-investigators> (accessed 30 January 2019).
- Reckon LLP 2009, *Study to quantify and analyse the VAT gap in the EU-25 Member States*, report, London, 21 September, https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/tax_cooperation/combating_tax_fraud/reckon_report_sep2009.pdf.
- Ruffles, D, Tily, G, Caplan, D & Tudor, S 2003, 'VAT missing trader intra-Community fraud: The effect on Balance of Payments statistics and UK National Accounts', *Economic Trends*, no. 597, pp. 58-70, <https://www.ons.gov.uk/ons/rel/elmr/economic-trends--discontinued-/no--598--august-2003/vat-missing-trader-intra-community-fraud--the-effect-on-balance-of-payments-statistics---uk-national-accounts-.pdf>.
- Sá, C, Martins, A & Gomes, C 2014, 'The influence of demographic factors and risk aversion on tax morale: A multi-group analysis', *European Journal of Research on Education*, vol. 2, no. 2, pp. 82-93, <http://iassr2.org/rs/020209.pdf>.
- Slemrod, J 2007, 'Cheating ourselves: The economics of tax evasion', *Journal of Economic Perspectives*, vol. 21, no. 1, pp. 25-48.
- Thackray, M 2012a, 'The UK tax gap', presentation to the Third IMF-Japan High-Level Tax Conference for Asia and Pacific Countries, Tokyo, 31 January-3 February, <http://www.imf.org/external/np/seminars/eng/2012/asiatax/>.

- Thackray, M 2012b, 'Applied tax gap analysis in the United Kingdom: Its use in tax administration, and future research', presentation, June, www.taxpolicycenter.org/sites/default/files/2-3-thackary.ppt (accessed 29 January 2019).
- Thackray, M 2012c, 'Applied tax gap analysis in the United Kingdom: Its use in tax administration, and future research', in Plumley, A (ed.), *New research on tax administration: An IRS-TPC conference*, Internal Revenue Service, Washington, DC, pp. 91-102, <https://www.irs.gov/statistics/soi-tax-stats-2012-irs-tpc-research-conference>.
- Thackray, M & Ueda, J 2014, 'Estonia: Technical assistance report – Revenue administration gap analysis program – The value-added tax gap in Estonia', International Monetary Fund Country Report No. 14/133, Washington, DC, January, <https://www.imf.org/external/pubs/ft/scr/2014/cr14133.pdf>.
- Thackray, M, Hutton, E & Kapoor, K 2015a, 'Denmark: Technical Assistance Report – Revenue administration gap analysis program – The value-added tax gap', International Monetary Fund Country Report No. 16/59, Washington, DC, March, <https://www.imf.org/external/pubs/ft/scr/2016/cr1659.pdf>.
- Thackray, M, Hutton, E & Kapoor, K 2015b, 'Finland: Technical Assistance Report – Revenue administration gap analysis program – The value-added tax gap', International Monetary Fund Country Report No. 16/60, Washington, DC, November, <https://www.imf.org/external/pubs/ft/scr/2016/cr1660.pdf>.
- Toro, J, Ogata, K, Hutton, E & Caner, S 2013, 'United Kingdom: Technical assessment report – Assessment of HMRC's tax gap analysis', International Monetary Fund Country Report No. 13/314, Washington, DC, August, <https://www.imf.org/external/pubs/ft/scr/2013/cr13314.pdf>.
- Warren, N 2014, 'A politically viable strategy for limiting personal income tax deductions: The case for a global cap', *Australian Tax Forum*, vol. 29, no. 3, pp. 357-389.
- Warren, N 2016a, 'e-filing and compliance risk: Evidence from Australian personal income tax deductions', *Australian Tax Forum*, vol. 31, no. 3, pp. 577-602.
- Warren, N 2016b, 'Tax gap and its key role in informing tax policy design, revenue administration and official statistics', Seminar presented to Australian Treasury, Canberra, 27 June (on file with author).
- Warren, N & McManus, J 2007, 'The impact of tax gap on future tax reforms', *Australian Economic Review*, vol. 40, no. 2, pp. 200-207.